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Post-Flight BET Products for the 2nd Discovery Entry,
STS-19 (51-A)

(NASA-CR-172572) POST-FLIGHT BET PRODUCTS
FOR THE 2ND DISCOVERY ENTRY, STS-19 (51-A)
(Analytical Mechanics Associates, Inc.)
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ABSTRACT

The post-flight products for the second **Discovery** flight, STS-19 (51-A), have been completed and are summarized herein. The inertial Best Estimate Trajectory, BT19D19/UN=169750N, was developed as discussed in **Section I** using spacecraft dynamic measurements from IMU 2 in conjunction with the best tracking coverage available to date for any of the earlier Shuttle entries. As a consequence of the latter, an anchor epoch was selected which conforms to an initial altitude of greater than a million feet. The Extended BET, ST19BET/UN=274885C, incorporated the previously mentioned inertial reconstructed state information and the LaRC generated LAIRS atmosphere, ST19MET/UN=712662N, with some minor exceptions as discussed in **Section II**. Primary and back-up AEROBET reels are NK0165 and NK0201, respectively. This product was only developed over the lowermost 360 kft altitude range due to atmosphere problems but this relates to altitudes well above meaningful signal in the IMUs. **Section III** presents summary results generated from the AEROBET for this flight with meaningful configuration and statistical comparisons from the previous thirteen flights.

MMLE files were generated based on IMU 2 and RGA/AA measurements as discussed in Section IV. Tapes generated were NK0202 and NK0203 for the IMU and RGA/AA, respectively.

Appendices attached define spacecraft and physical constants utilized (Appendix A), show plots of the final tracking data residuals from the post-flight fit (Appendix B), list relevant parameters from the BET at a two(2) second spacing (Appendix C), and retain for archival purposes all relevant input and output tapes and files generated (Appendix D).

Summary flight times and events are given in the following table:

[illegible]

Event	Time from epoch (secs)	Altitude (kft)
Entry interface	1038	400
Initial flight extraction	1179	320
Maximum Mach number (~27)	1276	272
M25	1472	242
M20	1777	217
M15	1980	190
M10	2142	165
M5	2354	118
M2	2534	75
M1	2628	50
Main gear deployment	2877	~0
Weight on wheels (WOW)	2892	-.2
Weight on nose (WONG)	2909	-.2
Stop time	2955	-.2

I. Entry Trajectory Reconstruction

I.a. Dynamic Data

None of the problems that surfaced during the Operational Recorder data reduction for the STS-17 flight were encountered on this flight. Selection of IMU 2 as the dynamic data source for STS-19 was rather straightforward. Though mid-value selection based on the accelerometer measurements indicated IMU 3 was better in the y-component, IMU 2 was selected in the x- and z- directions some 61 and 59 percent, respectively. In terms of total angle as measured by the gyros, IMU 2 represented mid-value measurements 89 percent of the time. Total angular rate mid-value measurements were essentially spread equally across the three IMUs. There were no appreciable data gaps in the OI data, that is, there were none greater than four (4) seconds. Also, there were virtually no manual data deletions required. Clearly the downlist for this flight was much more nominal.

There was some special treatment required for this flight in view of the more lengthy files required to accomodate the additional tracking coverage available. Because of dimensional constraints in the PREIMU software, dynamic data files were divided into two time intervals, processed serially using the spline utility and merged thereafter. Also, though of no major

impact, IMU 3 revealed Euler angle gimbal flips requiring use of a different Euler sequence. Fortunately the software provides for such an alternative as it has occurred previously.

Figure I-1 shows plots of the body-axes derived rates and accelerations from IMU 2 for this flight. The data are strip-charted over 500 second intervals between 1125 seconds and 2892 seconds. The first time conforms to the start of the AEROBET as discussed later. The final time relates to vehicle maingear touchdown. All signal of interest is covered herein.

I.b. Tracking coverage

Tracking data were obtained from four (4) S-band radars and fourteen (14) C-band trackers. This extensive tracking coverage, which included stations from California, Arizona, and New Mexico as well as Pacific and Florida stations, makes STS-19 the best tracked of the Shuttle entries to date. In order to fully utilize the available tracking data, a three (3) degree elevation angle constraint, rather than the usual five (5) degree minimum, was imposed on the passes from Guam (GWMS), California (VDBC, VDSC), and one New Mexico station (WSSC). For all other stations the standard five degree minimum elevation constraint was used. Since cine-theodolite data were not available from the Cape, the end conditions for the reconstructed trajectory were improved by utilizing pseudo altimeter data during rollout and pseudo Doppler data after vehicle stop on Runway 15 at KSC.

Tracking coverages are depicted in Figures I-2 through I-4. Figure I-2 shows the entire ground track for STS-19, with tracking stations shown as annotated. Times and corresponding altitudes at 500 second increments along the track are also given. Annotation for each tracker includes the geographic location and,

in parentheses, the number of trackers at that complex followed by the maximum elevation angle measured at that locale. Detailed tracking coverage is shown in **Figure I-3**. The tracking arcs actually used for trajectory reconstruction are shown by dashed "rays" from the stations to the ground track. Pertinent times and altitudes are also given. An expanded view of the final approach and landing segment is given as **Figure I-4**. Acronyms and locations for the STS-19 trackers are given in **Table I**.

I.c. Reconstruction results

The final BET solution for STS-19, BT19D19, is presented in Table II. For comparison, the initial estimate from the onboard navigation system, the JSC/TRW estimate, and a state-only ENTREE estimate are also given. Comparison of the two ENTREE estimates shows that a significant improvement in the fit to the tracking data is achieved by expanding the solution set to include accelerometer scale factors. The state and attitude for the final solution are in very close agreement with the state only solution, and, the instrument parameter errors are in accord with the 1 sigma performance levels of 100 ppm. There is also very good agreement between the JSC/TRW and BT19D19 solutions both at epoch and throughout the entry trajectory. The weighted fit statistics for BT19D19, based on 7823 observations, are $\underline{\mu}_W = -0.224$ and $\underline{\sigma}_W = 1.232$. A summary of the residuals, by station and data type, is given in Table III. Plots of the final residuals are presented as Appendix B. Composite residuals are included in this section. Composite post-fit residuals are given in Figure I-5 (range, Doppler), I-6 (azimuth, elevation), and I-7 (X- and Y-angles). Symbols utilized for the composite residual plots are as follows:

Key to Symbols for Composite Residuals

STATION	SYMBOL
GWMS	○
KMTC	□
HAWS	◇
KPTC	△
VDBC	▵
VDSC	▽
MTLC	◻
SPKC	◊
WSSC	◊
WHSC	◻
HOLC	⊕
MILS	⊕
MLXS	⊕
MLMC	⊕
MLAC	⊕
PATC	⊕
CNMC	⊕
CNVC	⊕

Comparisons of the final BET position and velocity after rollout on Runway 15 versus survey values are:

End conditions at vehicle stop (Runway 15 coordinates)

	<u>Survey</u>	<u>BT19D19</u>
X,ft	12186	12201
Y,ft	0	23
h-h _{rw} ,ft	16	16
X,fps	0	-.01
Y,fps	0	.20
h,fps	0	.04

Figure I-8 presents plots of the BET during rollout. Surveyed values are depicted thereon. Vehicle stop occurs 2955 seconds after epoch.

TYPE	STATION NO. NAME	GEOD. LAT. (DEG)	LONGITUDE (DEG)	GEOD. ALT. (FT)	MODULUS OF REFR.	SCALE HGT. (M)	MAX ELEV. (DEG)
S-BAND, N-S	1 GWMS	13.31063	144.73681	380.4100	346.	6877.	4.
C-BAND, FPQ-19	2 KMTC	8.71950	167.71837	91.5700	N/A	N/A	49.
S-BAND, N-S	3 HAWS	22.12624	200.33484	3739.3400	317.	6343.	30.
C-BAND, FPQ-14	4 KPTC	21.57210	201.73343	931.4000	N/A	N/A	20.
C-BAND, TPQ-18	5 VDBC	34.66587	239.41865	203.5433	321.	7225.	4.
C-BAND, FPS-18	6 VDSC	34.58276	239.43853	1972.1457	303.	6955.	4.
C-BAND, CAPRI	7 MTLC	32.44172	249.21120	9036.4800	232.	7664.	8.
C-BAND, FPS-16	8 SPKC	31.55683	249.56183	5822.0800	265.	7292.	12.
C-BAND, FPS-16	9 WSSC	33.81391	253.34100	4886.9400	255.	8138.	4.
C-BAND, FPS-16	10 WHSC	32.35810	253.63019	3905.9700	270.	7932.	8.
C-BAND, FPS-16	11 HOLC	32.90151	253.90083	4012.9600	265.	8080.	6.
S-BAND, N-S	12 MILS	28.50827	279.30663	-178.6400	346.	7006.	21.
S-BAND, E-W	13 MLXS	28.50831	279.30727	-183.1400	346.	7008.	33.
C-BAND, MCBR	14 MLMC	28.62609	279.31723	-173.9800	N/A	N/A	58.
C-BAND, FPQ-14	15 MLAC	28.42486	279.33564	-172.0100	N/A	N/A	24.
C-BAND, FPQ-14	16 PATC	28.22655	279.40075	-160.3700	N/A	N/A	16.
C-BAND, MBR-17	17 CNMC	28.52888	279.40982	-195.1800	N/A	N/A	30.
C-BAND, FPS-16	18 CNVC	28.48176	279.42353	-163.9100	N/A	N/A	25.

Table I. STS-19 station locations and refraction data.

EPOCH: 11/16/84 11^h11^m40^s (40300^s) GMT

DATA TYPES: S-band, 4 radars (GWMS, HAWS, MILS, MLXS)
 C-band, 14 radars (KMTIC, KPTC, VDBC, VDSC, MTLC, SPKC, WSSC,
 HOLC, WHSC, MLMC, MLAC, PATC, CNMC, CNVC)
 Pseudo altimeter (Post WONG); Pseudo Doppler (Post STOP)

COMMENTS: 3° constraint on GWMS, VDBC, VDSC, WSSC; 5° constraint all other stations

PARAMETER	Initial Estimate, Nav	JSC/TRW	BT19D17 (1)	Final Solution, BT19D19 (2)
V_R , fps	23706.7	23704.2	23705.1	23704.959
γ_R , deg	-1.190	-1.189	-1.188	-1.1877712
ψ_R , deg	60.107	60.109	60.107	60.106823
h_D , ft	1043495.	1044928.	1044501.	1044473.3
ϕ_D , deg	-5.039	-5.039	-5.039	-5.0392872
λ , deg	140.348	140.347	140.347	140.34734
ψ , deg	53.713	53.786	53.802	53.793444
θ , deg	-70.952	-70.972	-70.961	-70.963337
ϕ , deg	1.675	1.597	1.587	1.5963170
μ_w	---	---	-1.503	-0.224
σ_w	---	---	3.067	1.232

(1) state only

(2) state and accelerometer scale factors $\{\Delta SF_X, \Delta SF_Y, \Delta SF_Z \text{ (ppm)} = +23, +73, +16\}$

Table II. STS-19 solution and comparisons.

OBSERVATION STATISTICS BASED ON FINAL STATE

STATION NO.	OBSERVATION NAME	OBSERVATION TYPE	OBSERVATIONS ACCEPTED	AVERAGE WEIGHT. RES.	AVERAGE RESIDUAL	STANDARD STAND. DEV.	WEIGHTED STAND. DEV.
0	ALTIMETER		86 OF	86	-.91915120E+00	.89934704E+00	.18736397E+00
1	GWMS RANGE		145 OF	145	.34031163E+01	.78600280E+01	.64203117E+00
1	GWMS DOPPLER		145 OF	145	-.46707597E-02	.77986929E+00	.22161494E+01
1	GWMS X-ANGLE		145 OF	145	-.11058532E+00	.82751450E-01	.73463239E+00
1	GWMS Y-ANGLE		145 OF	145	-.10667339E-01	.13654233E-01	.11322559E+01
2	KMTC RANGE		51 OF	51	.39928413E+02	.69272484E+02	.22959555E+01
2	KMTC AZIMUTH		55 OF	55	-.82515999E-02	.44311627E-02	.38669189E+00
2	KMTC ELEVATION		55 OF	55	.53152891E-02	.75477029E-02	.50490370E+00
3	HAWS RANGE		150 OF	150	-.61880530E+01	.62054521E+01	.95455458E+00
3	HAWS DOPPLER		150 OF	152	-.94369401E-01	.53285561E+00	.14731141E+01
3	HAWS X-ANGLE		151 OF	151	.47231098E-02	.19581542E-01	.12475514E+01
3	HAWS Y-ANGLE		152 OF	152	-.19299761E-01	.51690796E-02	.44421661E+00
4	KPTC RANGE		184 OF	184	-.20209908E+01	.11084087E+02	.36484378E+00
4	KPTC AZIMUTH		201 OF	201	.46107878E-02	.26576992E-02	.23192801E+00
4	KPTC ELEVATION		201 OF	201	.54035033E-02	.62648016E-02	.37712359E+00
5	VDBC RANGE		28 OF	28	-.42587922E+02	.21256442E+02	.66910129E+00
5	VDBC AZIMUTH		28 OF	28	-.62682892E-03	.41101007E-02	.35867395E+00
5	VDBC ELEVATION		28 OF	28	.77168088E-02	.72591860E-02	.27919672E+00
6	VDSC RANGE		24 OF	25	.32799677E+01	.39613548E+02	.12612319E+01
6	VDSC AZIMUTH		24 OF	25	.70652051E-02	.32068135E-01	.27984727E+01
6	VDSC ELEVATION		25 OF	25	-.10994347E-01	.27207191E-01	.11725176E+01
7	MTLC RANGE		51 OF	51	-.41616342E+01	.47095140E+02	.15485199E+01
7	MTLC AZIMUTH		54 OF	54	-.18950693E-01	.21498436E-01	.18760925E+01
7	MTLC ELEVATION		54 OF	54	.42786025E-02	.15359505E-01	.99268640E+00
8	SPKC RANGE		34 OF	34	-.40391952E+02	.20724730E+02	.68171398E+00
8	SPKC AZIMUTH		37 OF	37	-.54752616E-02	.57162439E-02	.49883638E+00
8	SPKC ELEVATION		37 OF	37	-.13295306E-01	.11033466E-01	.68588097E+00
9	WSSC RANGE		34 OF	34	.28354459E+02	.22972651E+02	.73938376E+00
9	WSSC AZIMUTH		39 OF	39	.32678324E-02	.90330624E-02	.78828340E+00
9	WSSC ELEVATION		39 OF	39	.57784200E-02	.10454362E-01	.55262115E+00
10	WHSC RANGE		50 OF	50	.61329118E+01	.28270664E+02	.92393143E+00
10	WHSC AZIMUTH		52 OF	52	.88710749E-02	.88459095E-02	.77195123E+00
10	WHSC ELEVATION		52 OF	52	-.33389223E-02	.92482631E-02	.57610631E+00
11	HOLC RANGE		40 OF	40	-.11801504E+02	.21722775E+02	.70749086E+00
11	HOLC AZIMUTH		42 OF	42	-.50649167E-02	.86784016E-02	.75733341E+00
11	HOLC ELEVATION		41 OF	41	-.10551669E-02	.11280795E-01	.67828983E+00

Table III. STS-19 residual summary.

OBSERVATION STATISTICS BASED ON FINAL STATE

STATION NO.	OBSERVATION NAME	OBSERVATION TYPE	OBSERVATIONS ACCEPTED	AVERAGE WEIGHT, RES.	AVERAGE RESIDUAL	STANDARD STAND. DEV.	WEIGHTED STAND. DEV.
12	MILS RANGE		125 OF	-.50131582E+00	-.52193982E+01	.72086035E+01	.65867343E+00
12	MILS DOPPLER		123 OF	.87184091E-01	.87229637E-01	.45064755E+00	.44789387E+00
12	MILS X-ANGLE		125 OF	-.23923505E+00	-.30710200E-02	.67697822E-02	.47801790E+00
12	MILS Y-ANGLE		124 OF	.73463735E+00	.84206717E-02	.32944094E-02	.28749985E+00
13	MLXS RANGE		140 OF	.24950695E+01	.25346417E+02	.11815347E+02	.11675903E+01
13	MLXS DOPPLER		138 OF	-.18291537E+00	-.18327250E+00	.13066634E+01	.13050566E+01
13	MLXS X-ANGLE		140 OF	.36301871E+00	.42991673E-02	.13341009E-01	.11385545E+01
13	MLXS Y-ANGLE		140 OF	-.10935868E+00	-.12503100E-02	.14884653E-01	.12949236E+01
14	MLMC RANGE		271 OF	-.10653059E+00	-.32428644E+01	.36083461E+02	.11889419E+01
14	MLMC AZIMUTH		286 OF	-.10781922E+01	-.12355172E-01	.15917613E-01	.13890738E+01
14	MLMC ELEVATION		287 OF	-.74983637E+00	-.97181087E-02	.21907696E-01	.15955666E+01
15	MLAC RANGE		242 OF	-.68952869E+00	-.20782588E+02	.31033400E+02	.10265292E+01
15	MLAC AZIMUTH		262 OF	.41133789E+00	.47135850E-02	.69002323E-02	.60215886E+00
15	MLAC ELEVATION		263 OF	-.18065007E+00	-.25881400E-02	.63750564E-02	.50229162E+00
16	PATC RANGE		216 OF	-.65095184E+00	-.19731772E+02	.34729110E+02	.11364363E+01
16	PATC AZIMUTH		235 OF	.24687371E+00	.28289643E-02	.44461817E-02	.38800255E+00
16	PATC ELEVATION		236 OF	-.39733337E+00	-.51081403E-02	.73361821E-02	.45980976E+00
17	CNMC RANGE		251 OF	-.78214136E+00	-.23645620E+02	.34010802E+02	.11161693E+01
17	CNMC AZIMUTH		268 OF	-.33659950E+00	-.38571462E-02	.15052692E-01	.13135952E+01
17	CNMC ELEVATION		267 OF	.16077484E+00	.13062900E-02	.12351165E-01	.94984471E+00
18	CNVC RANGE		244 OF	-.77607010E+00	-.23301896E+02	.44997831E+02	.14867218E+01
18	CNVC AZIMUTH		264 OF	.20071776E-01	.23000561E-03	.97690568E-02	.85251103E+00
18	CNVC ELEVATION		265 OF	-.38752912E+00	-.55008520E-02	.11428139E-01	.83032269E+00
19	PSBV DOPPLER		41 OF	-.66711700E+00	-.20013510E+00	.61635244E-01	.20545081E+00
20	PSBN DOPPLER		41 OF	-.13828737E+01	-.41486210E+00	.12365674E+00	.41218914E+00

TOTAL WEIGHTED FIT STATISTICS---- NOBS = 7823 WGT. MEAN = -.22428048E+00 WGT. STD. DEV. = .12317620E+01

Table III. (concluded).

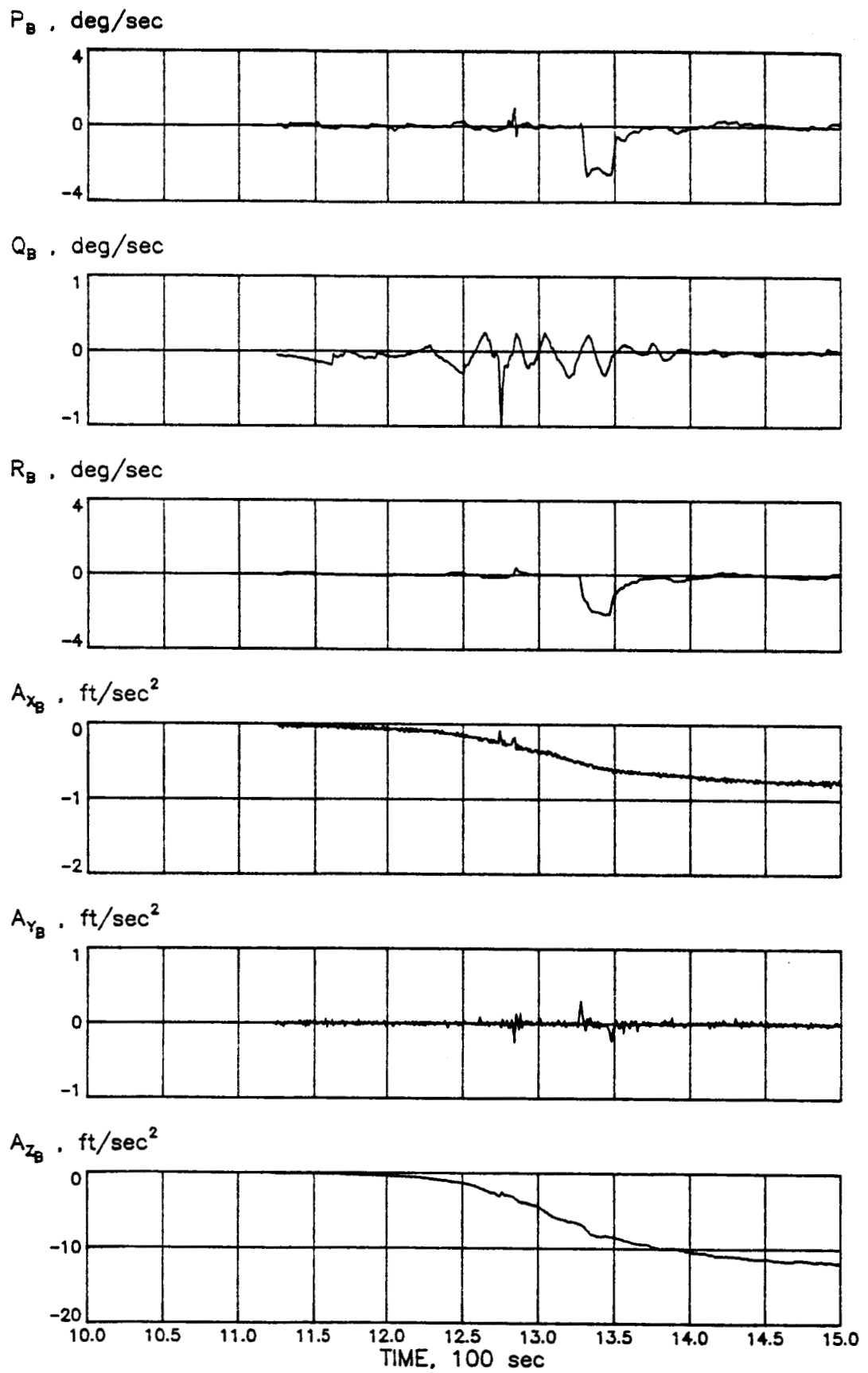
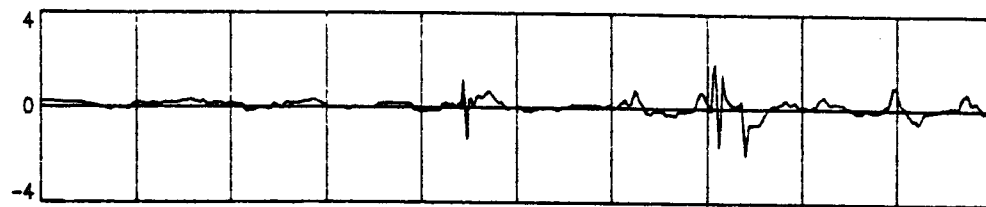
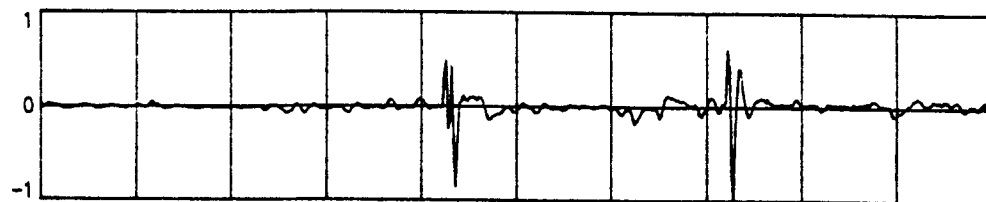


Figure I-1. STS-19 Dynamic data , IMU 2

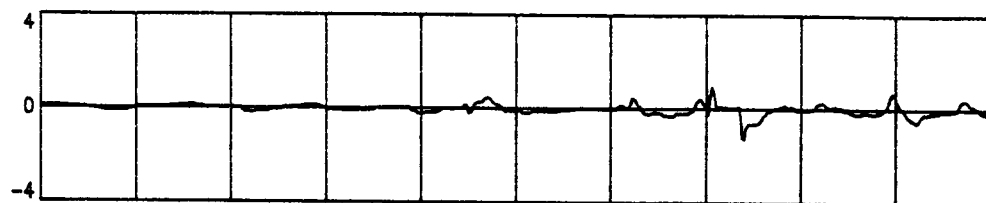
P_B , deg/sec



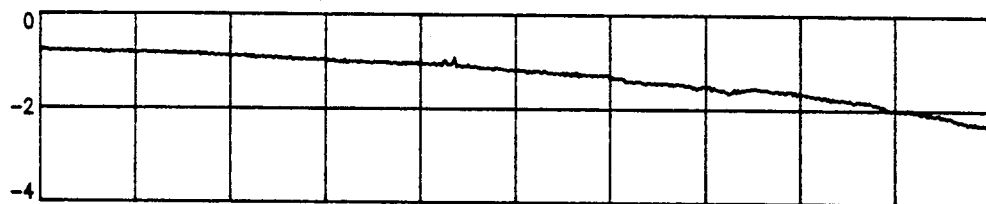
Q_B , deg/sec



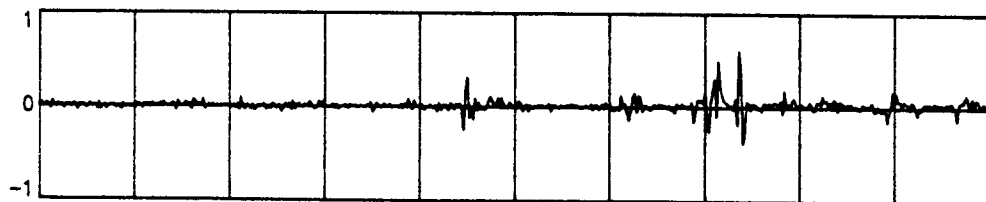
R_B , deg/sec



A_{x_B} , ft/sec²



A_{y_B} , ft/sec²



A_{z_B} , ft/sec²

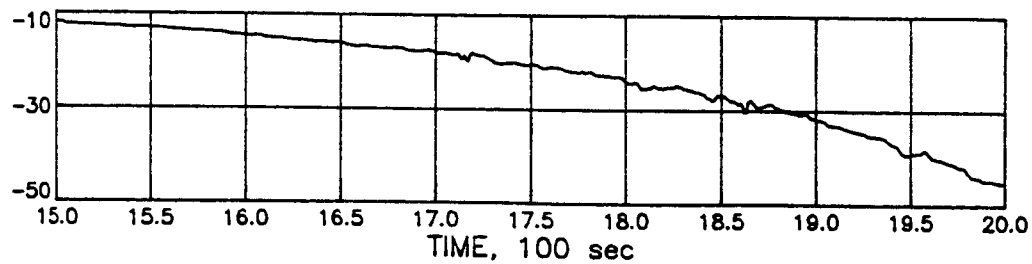
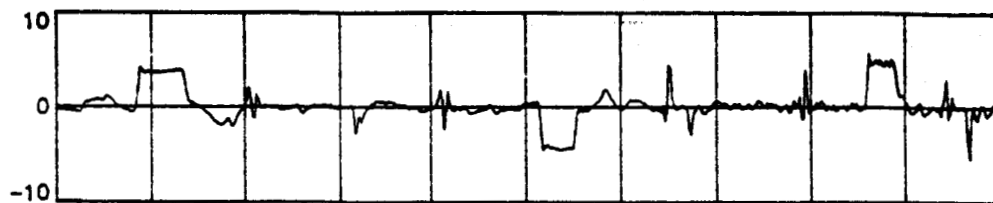
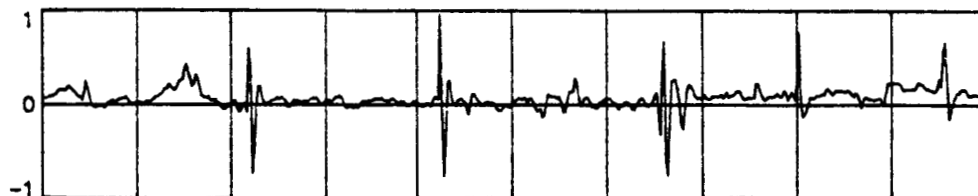


Figure I-1. (continued)

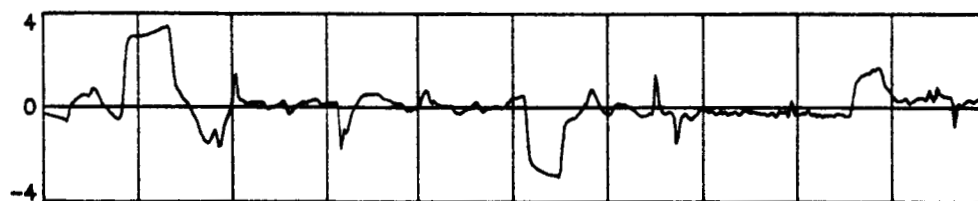
P_B , deg/sec



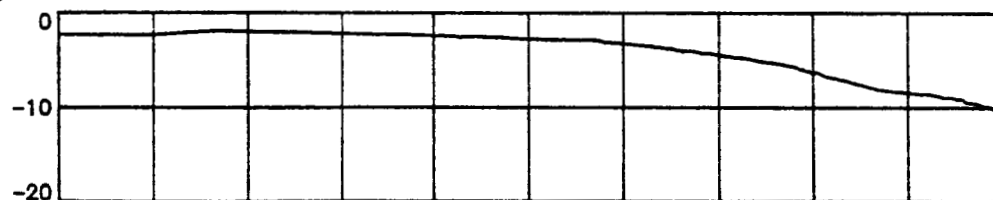
Q_B , deg/sec



R_B , deg/sec



A_{x_B} , ft/sec²



A_{y_B} , ft/sec²



A_{z_B} , ft/sec²

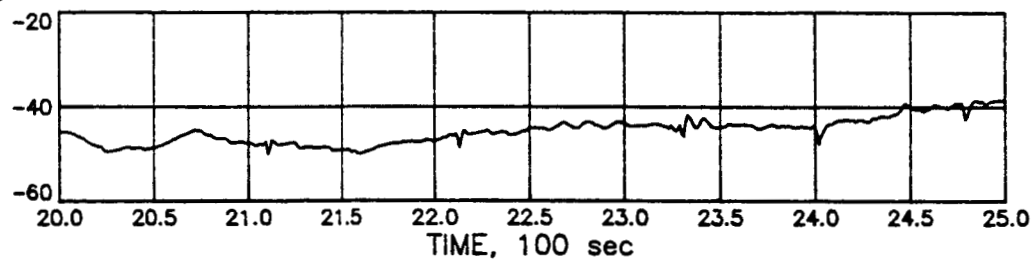
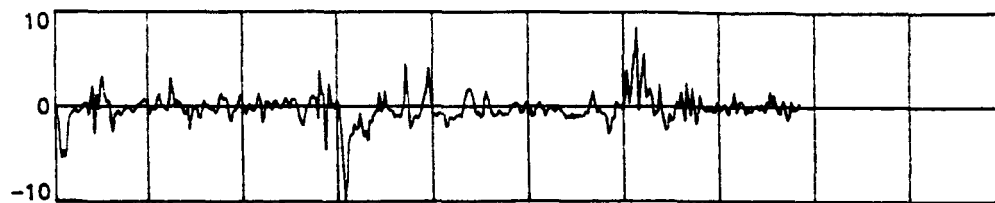
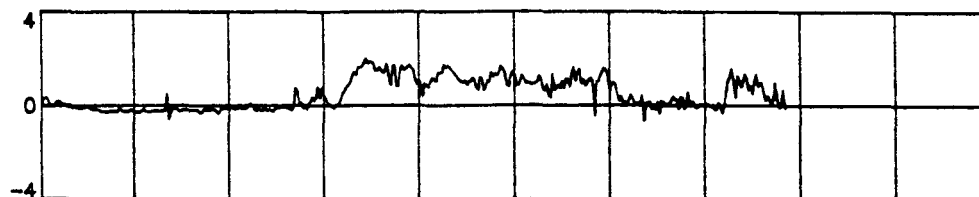


Figure I-1. (continued)

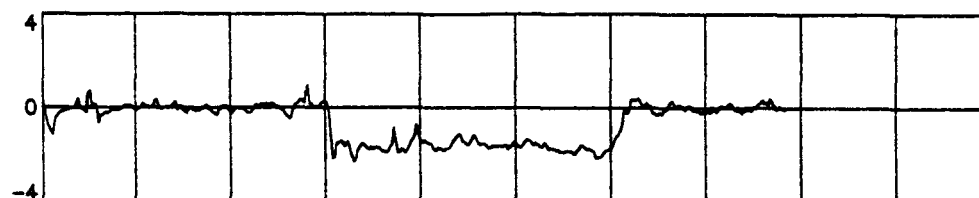
P_B , deg/sec



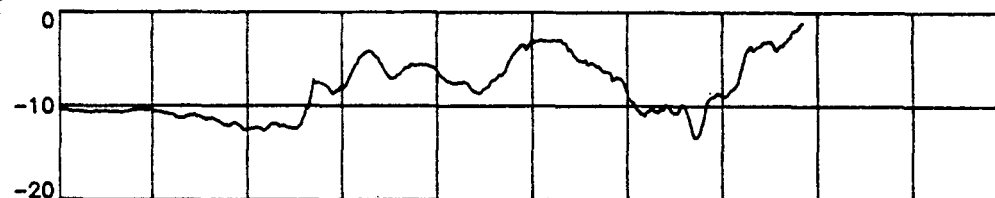
Q_B , deg/sec



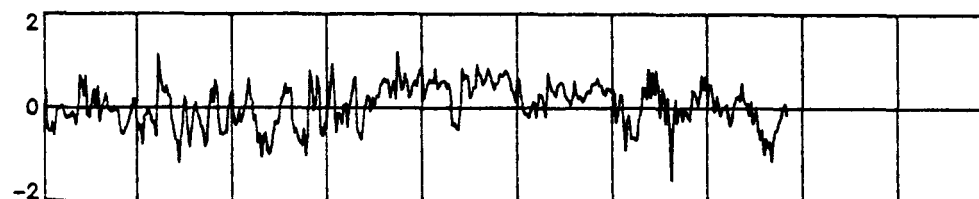
R_B , deg/sec



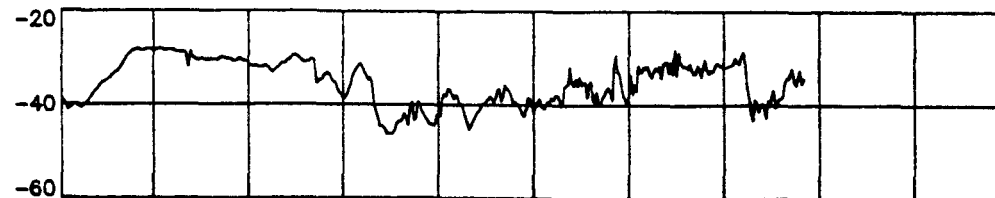
A_{x_B} , ft/sec²



A_{y_B} , ft/sec²



A_{z_B} , ft/sec²



TIME, 100 sec

Figure I-1. (concluded)

EPOCH: 11/16/84 11^h11^m40^s (40300^s) GMT

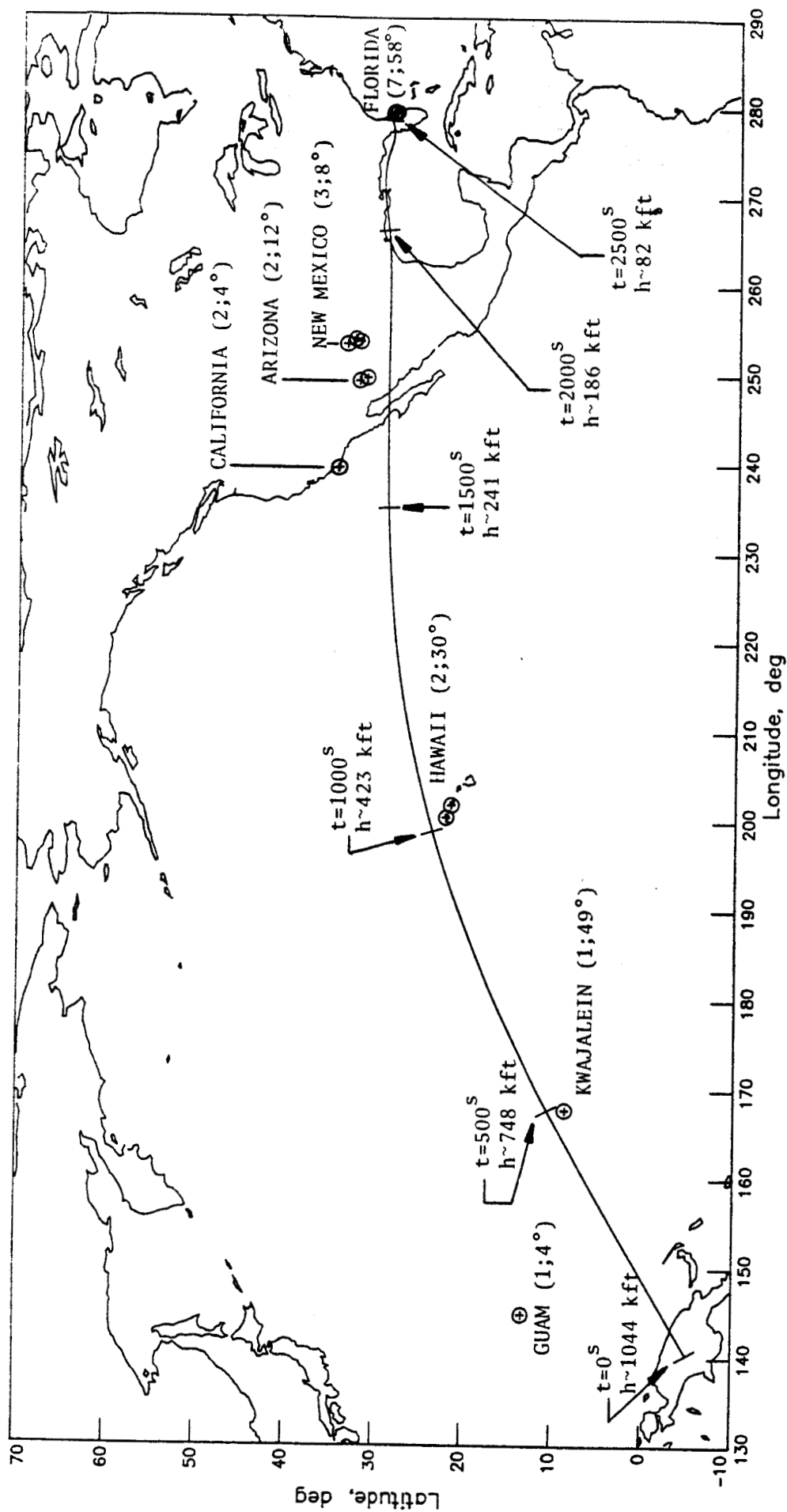


Figure I-2. STS-19 (51A) ground track from epoch to touchdown.

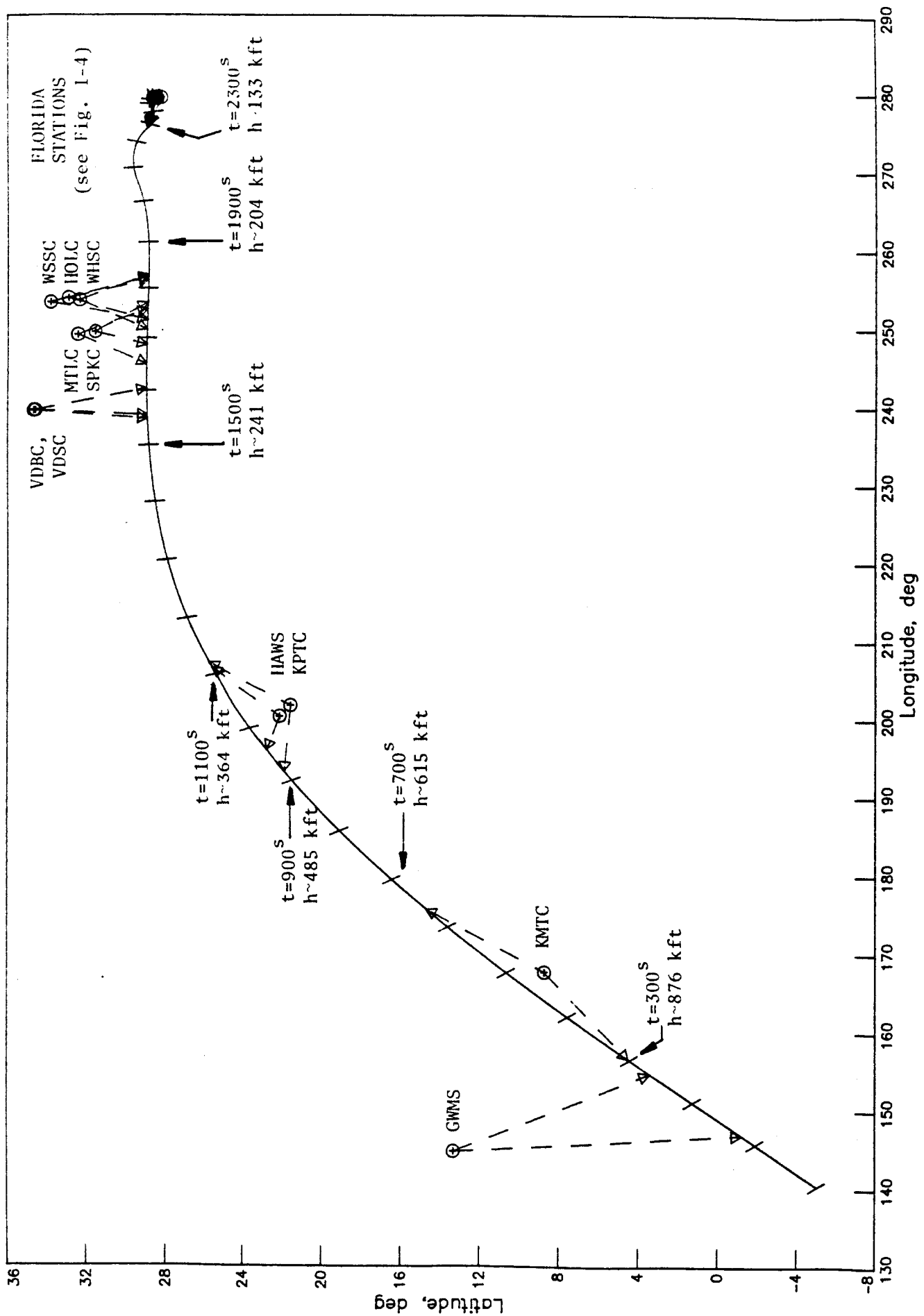


Figure I-3. STS-19 tracking coverage utilized in reconstruction process.

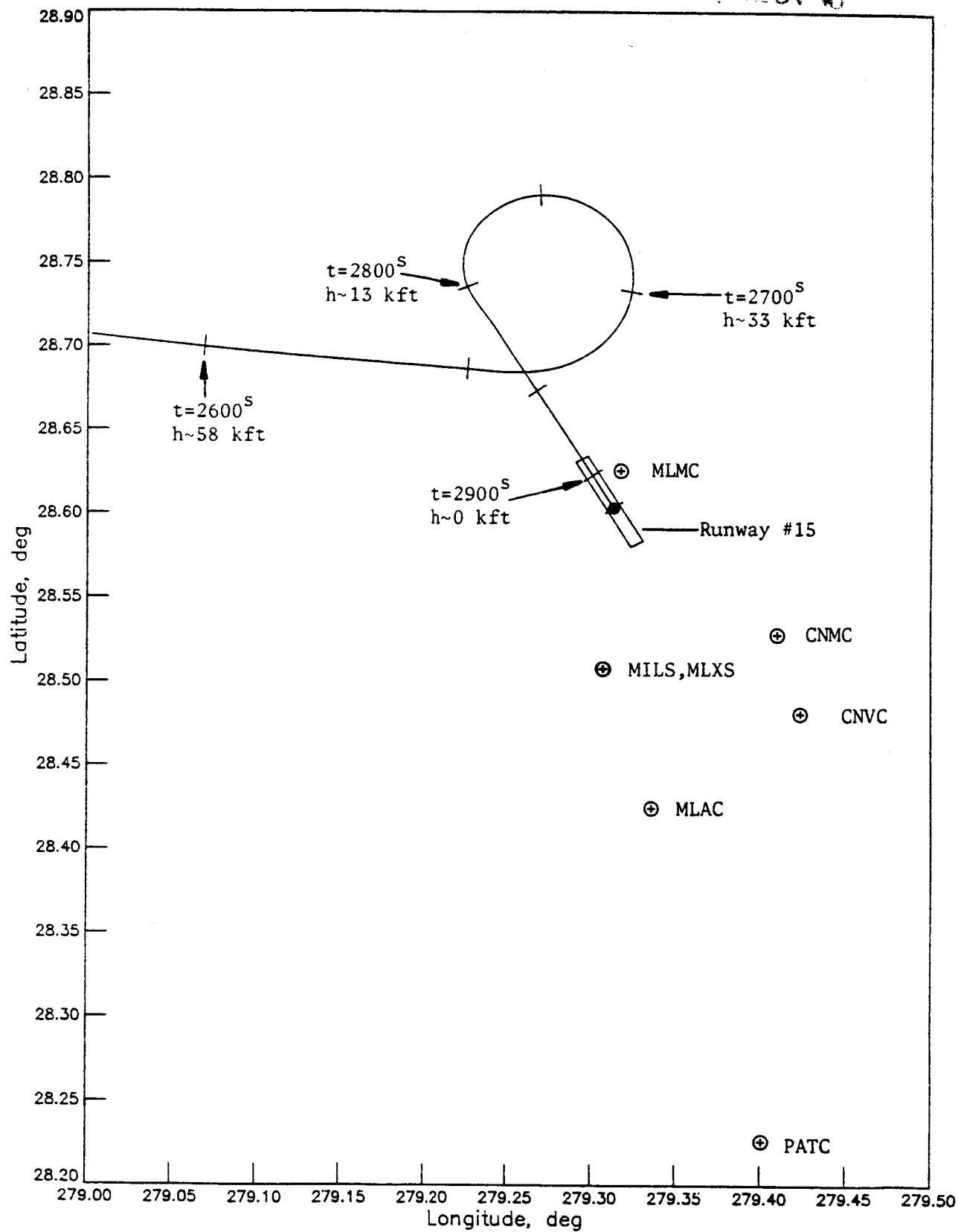
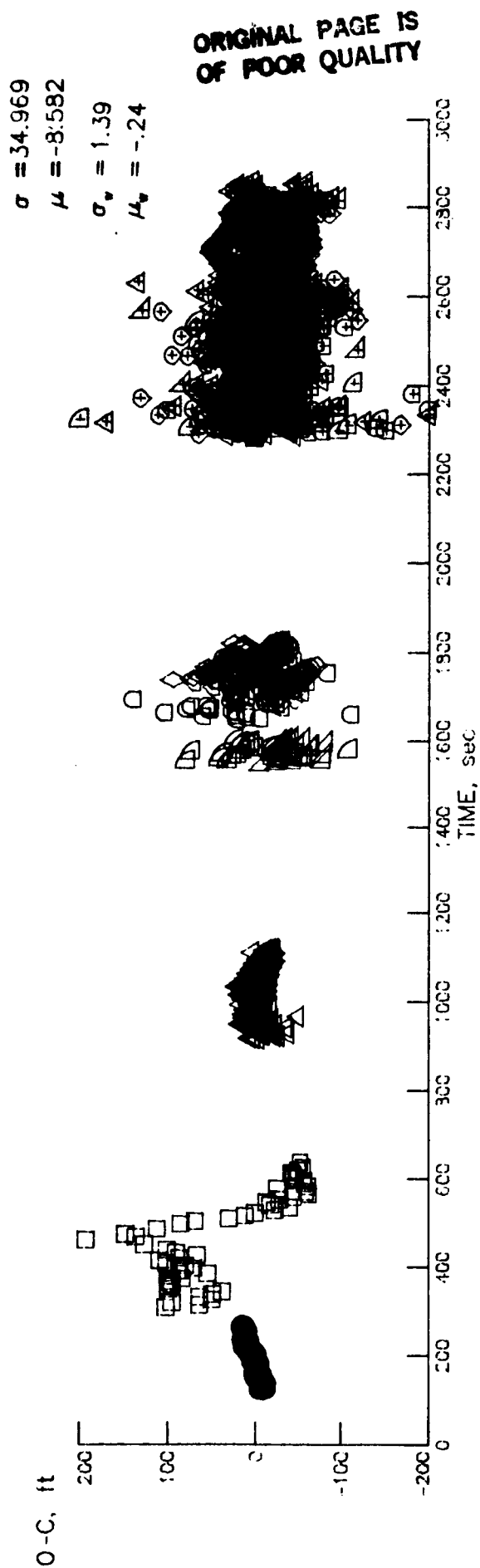


Figure I-4. STS-19 final approach and landing.



(a) Range residuals

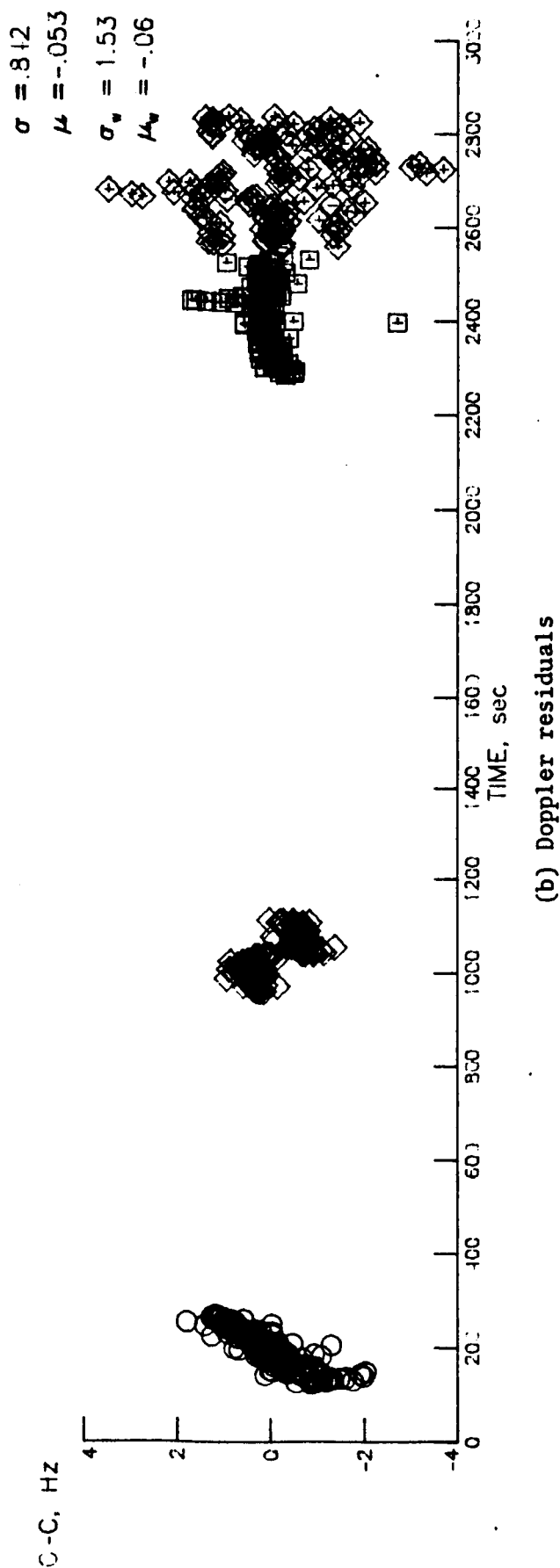


Figure I-5. STS-19 composite range and Doppler residuals.

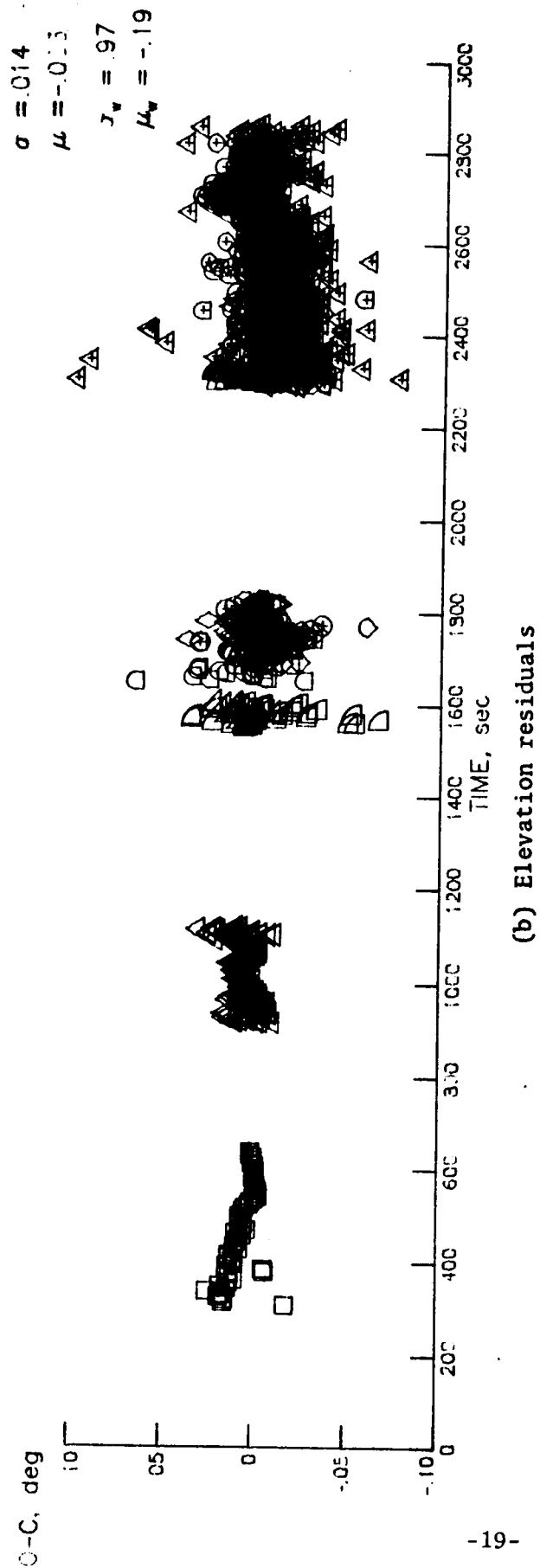
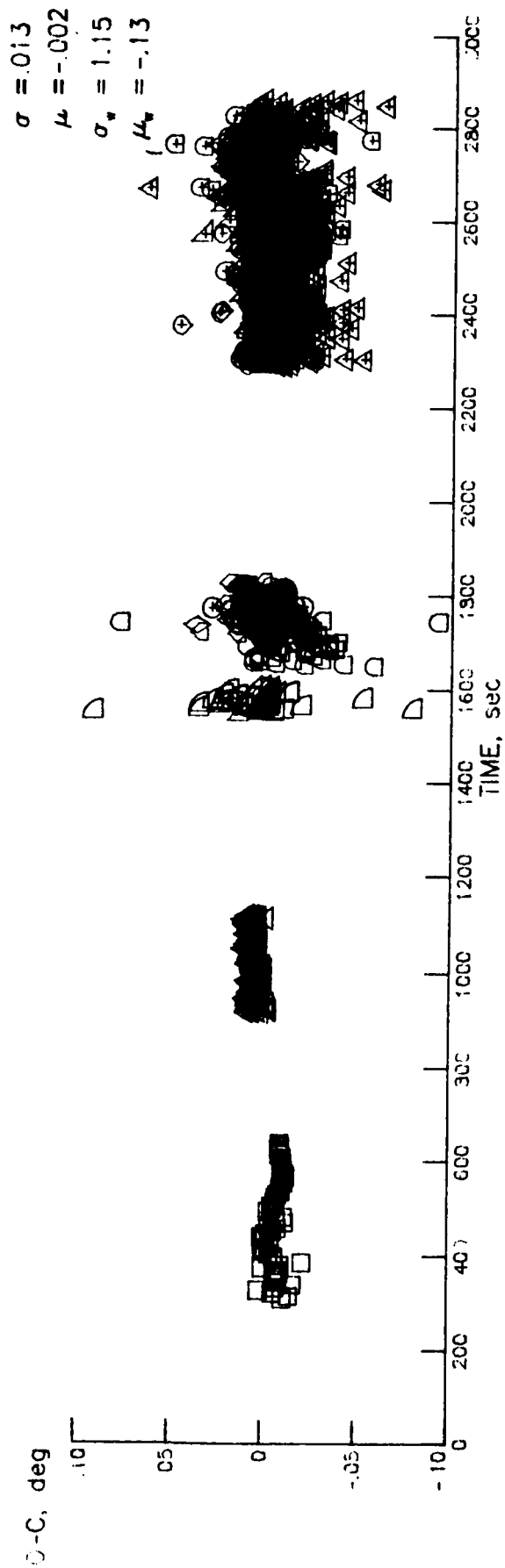


Figure I-6. STS-19 composite azimuth and elevation residuals.

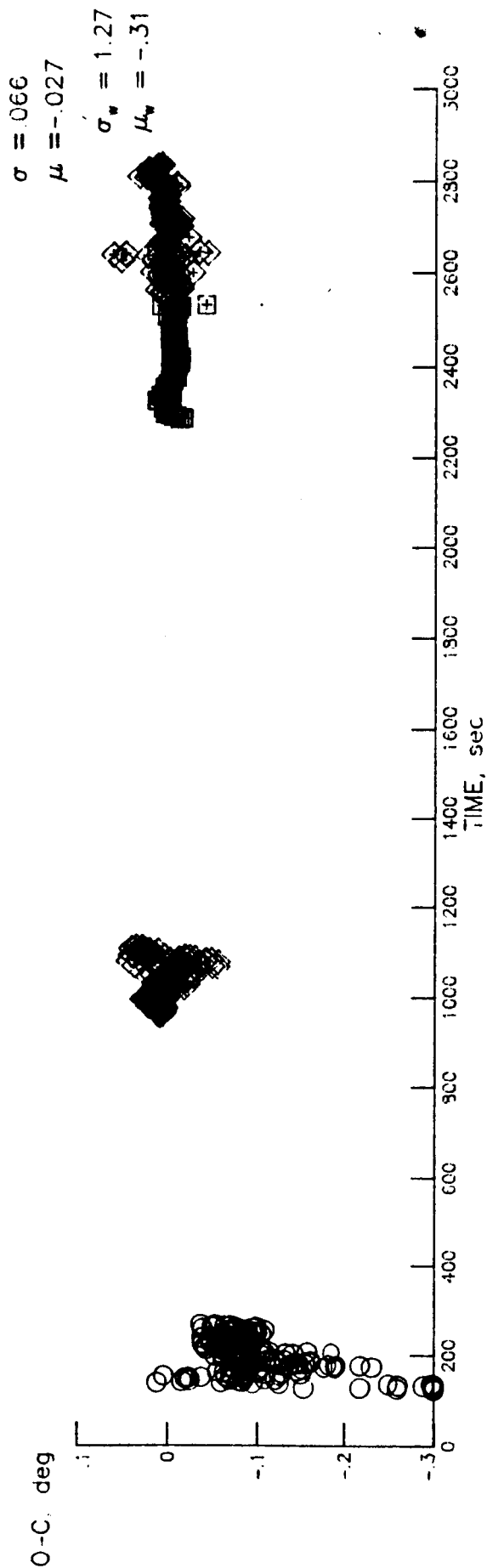


Figure I-7. STS-19 composite X-and Y-angle residuals.

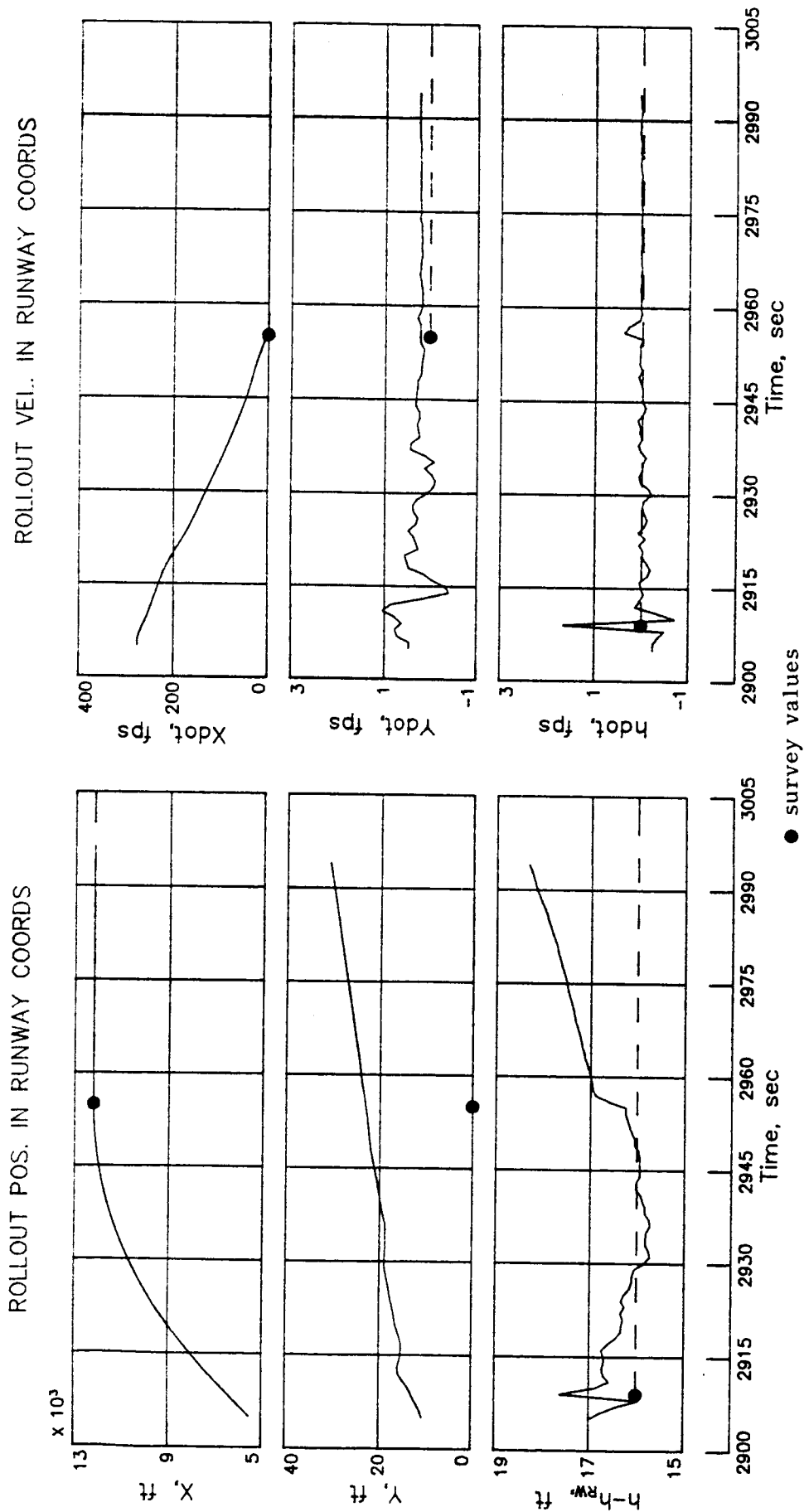


Figure I-8. Rollout position and velocity plots for STS-19.

II. Extended BET Development

The atmosphere selected for STS-19 (51-A) was the LAIRS file developed by J. M. Price, LaRC AB/SSD, designated as ST19MET/UN=712662N. Selection of this atmosphere is vindicated in the first few figures presented in the section. Comparisons are presented based on these data and the usual four(4) alternative sources, namely: the NOAA "totem-pole" data derived from the JSC BET, the MSFC Global Reference Atmosphere Model (GRAM), the USAF 1978 Reference Atmosphere (AF78), and Shuttle derived parameters. Symbols utilized on the plots are shown below:

○	LAIRS
●	NOAA
△	GRAM
□	AF78

Density, temperature, and pressure comparisons are presented as Figures II-1 through II-3, respectively. Two altitude regions are shown on each plot as a continuation with 50 kft overlap. The upper altitude plots cover the region between 350 kft and 150 kft. The lowermost 200 kft is covered in the continuation frame. Figure II-1 shows that the two measurement density sources are in better agreement with the Shuttle derived data than either of the models. The models tend to depart toward a more dense estimate above

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100 kft whereas the two remote sources are in reasonable agreement. Of course, neither source can be expected to reflect the density structure visible in the accelerometry. The major discrepancies between the remote sources to note are in the narrow interval between altitudes of 230 and 260 kft and, surprisingly, a fairly broad region centered around an altitude of 150 kft. Use of the NOAA data would indicate an underpredicted aerodynamic data base error at $h \sim 250$ kft which is not typical of the previous flight results. Therein, LAIRS would appear to be more appropriate. The difference at the lower altitude reflects an implied data base overprediction difference dependent upon which density source is selected, e.g., an additional six (6) percent overprediction would be suggested by the LAIRS data. Throughout this interval, the LAIRS data are in better agreement with the two models. Thus, on the basis of atmospheric density alone, the LAIRS file was selected. This is also true for pressure as can be seen in Figure II-3 but not substantiated in the temperature plot of Figure II-2. It is noted that the LAIRS density data do tend to depart quite drastically above 350 kft, actually exceeding 50 percent of Standard above 360 kft. As a consequence, the AEROBET and GTFILes were only generated below this altitude. This is of no consequence since the upper altitude is still substantially above that corresponding to meaningful signal in the IMUs.

Wind comparisons are shown as Figures II-4 and II-5 for the two remote sources and the GRAM data. In general, the major East-West component is in good agreement. Above 50 kft one has little recourse but to review these data for reasonableness. In the subsonic regime evaluations were made based on the in situ side probe measurements. These comparisons are summarized as Figures II-6 and II-7. The first of these two figures shows the LAIRS and NOAA winds superimposed on charts containing both batch and deterministic estimates of the winds. The notation, FLAIR19, is made since the LaRC file had to be modified slightly at the lower end. The modification involved merging the NOAA atmosphere over the bottom 2 kft wherein the LAIRS data were incomplete. Figure II-7 shows residual differences between the in situ air data parameters and those computed based on the FLAIR19 data. The results shown on each of these last two figures are well within the accuracy of quantifying the subsonic winds. Thus, the LAIRS data, modified as suggested, were adopted.

The remaining four figures in this section simply show the final atmospheric parameters for STS-19. The final temperature profile is plotted in Figure II-8 over the lowermost 360 kft. Similarly, final density and pressure profiles are shown in Figure II-9 and II-10, respectfully. Finally, southward and westward wind profiles are shown in Figure II-11.

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h , kft

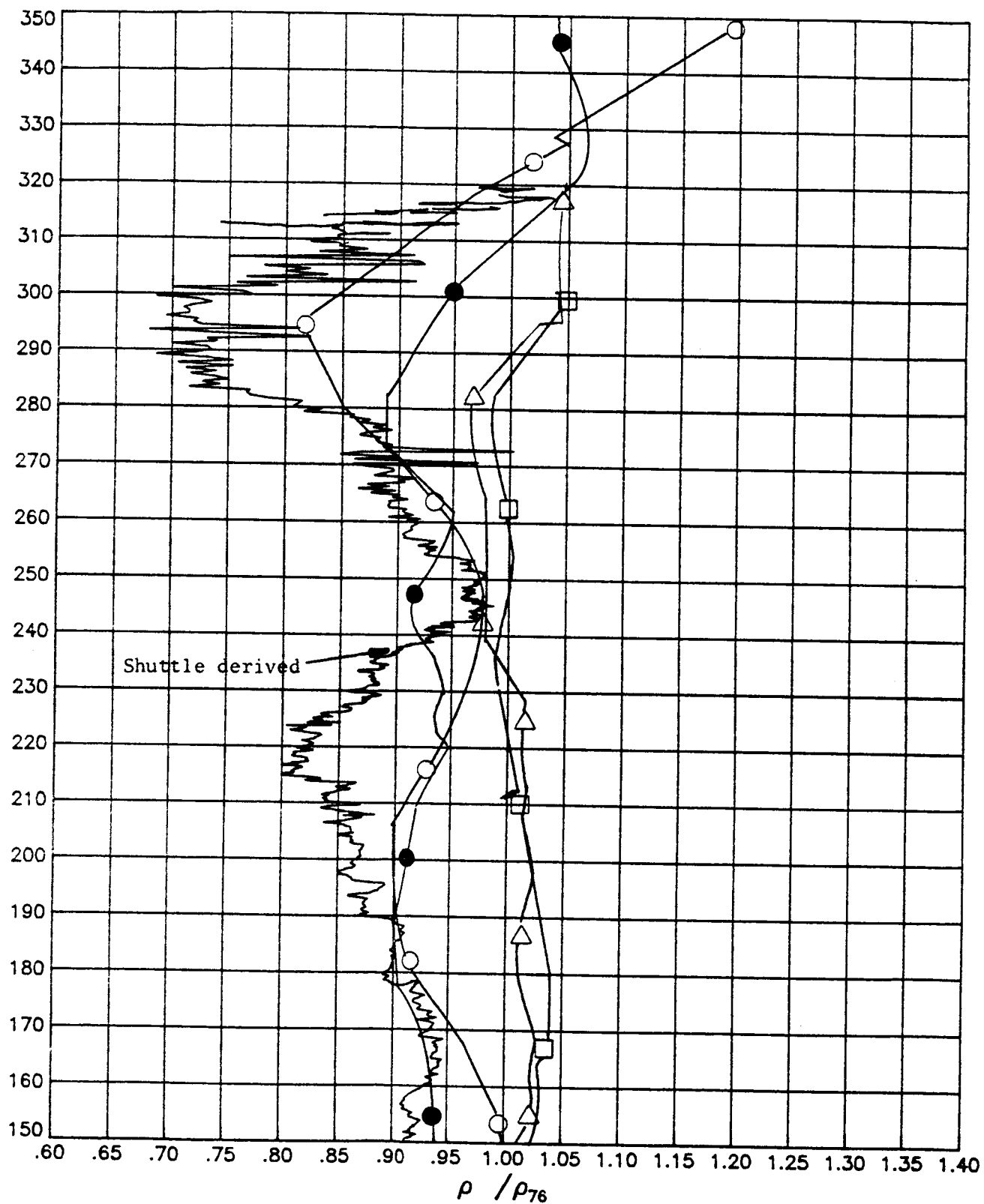


Fig. II-1 STS-19 (51-A) density comparisons

h, kft

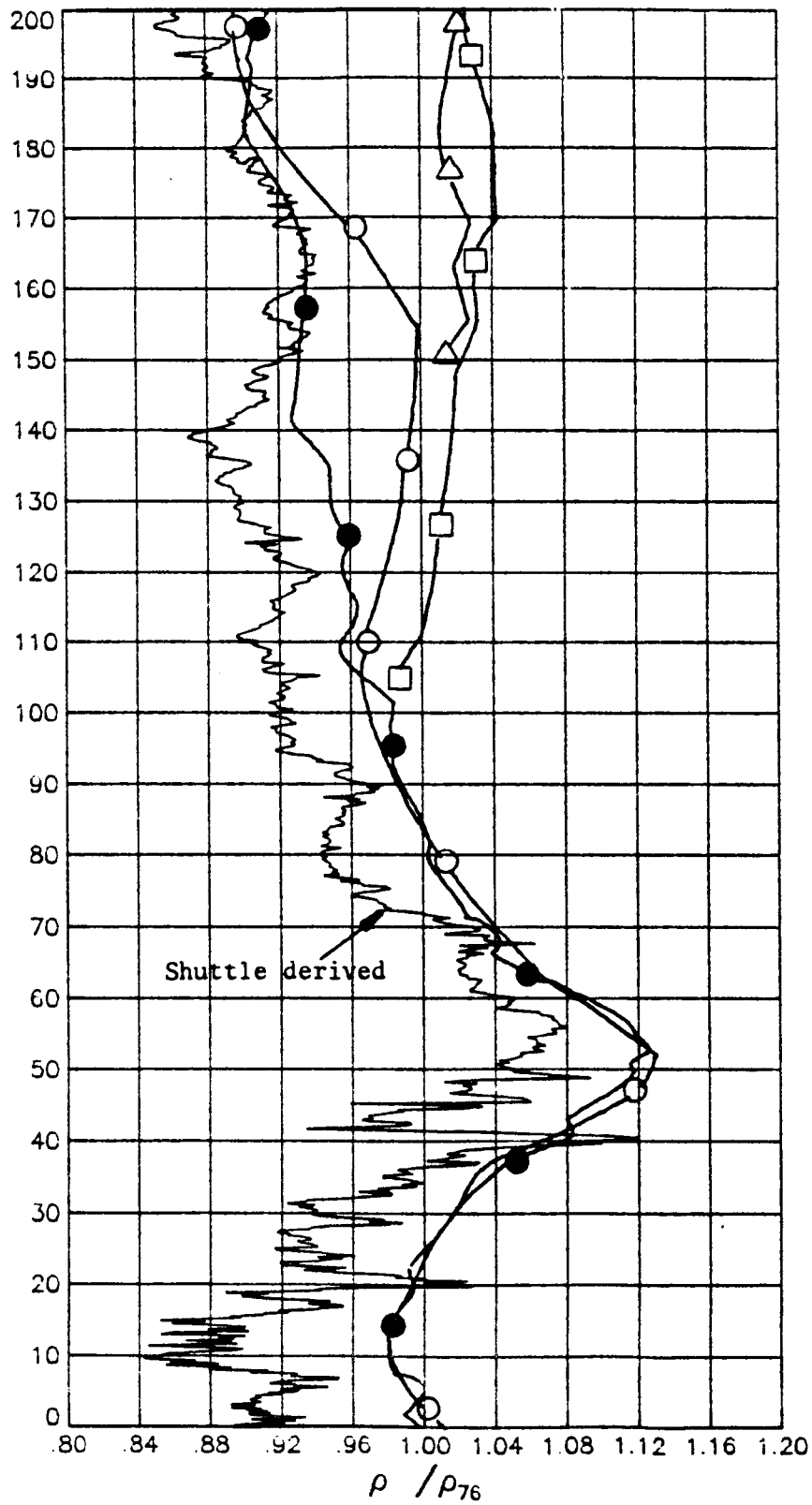


Fig. II-1 (concluded)

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h , kft

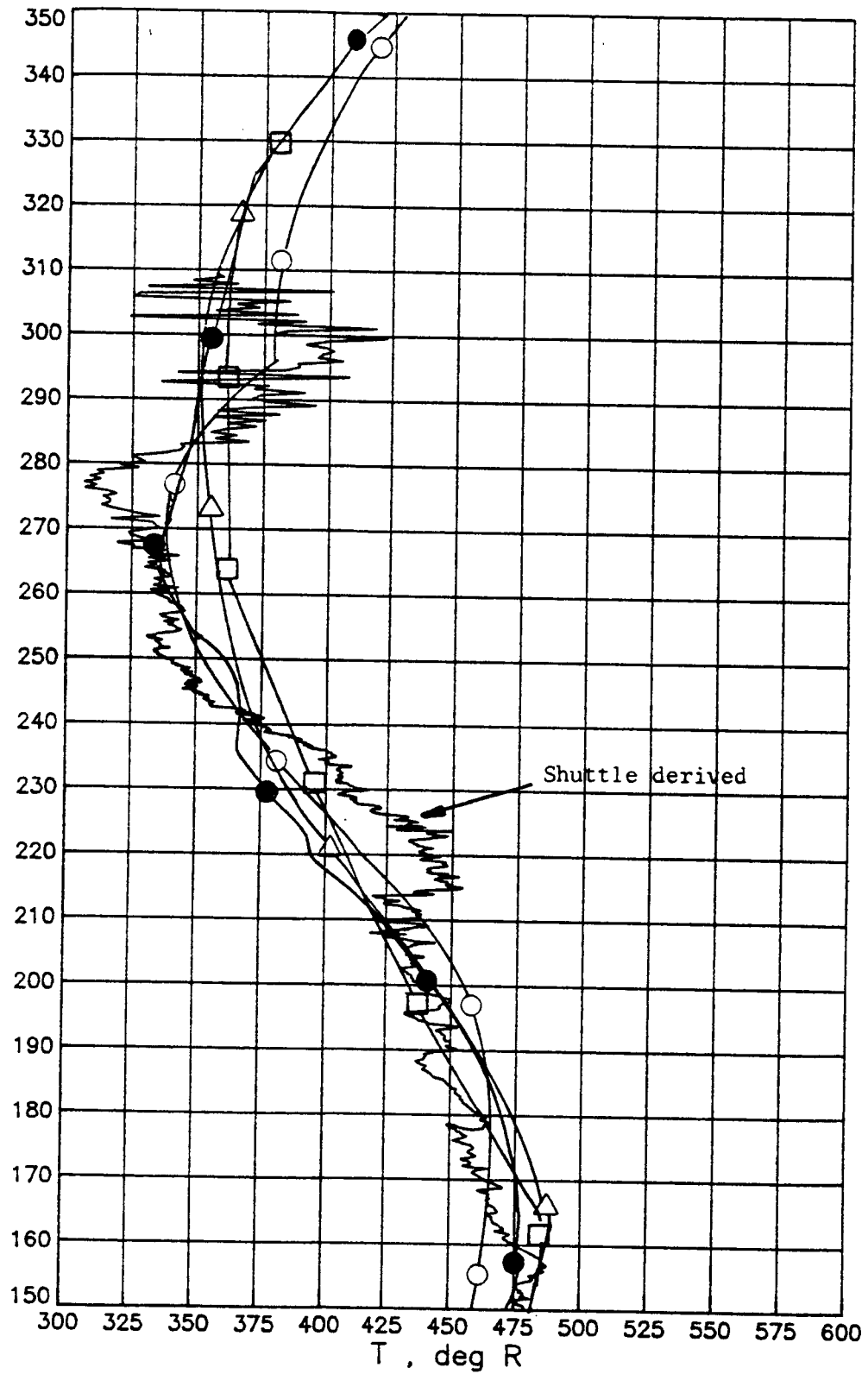


Fig. II-2 STS-19 (51-A) temperature comparisons

h , kft

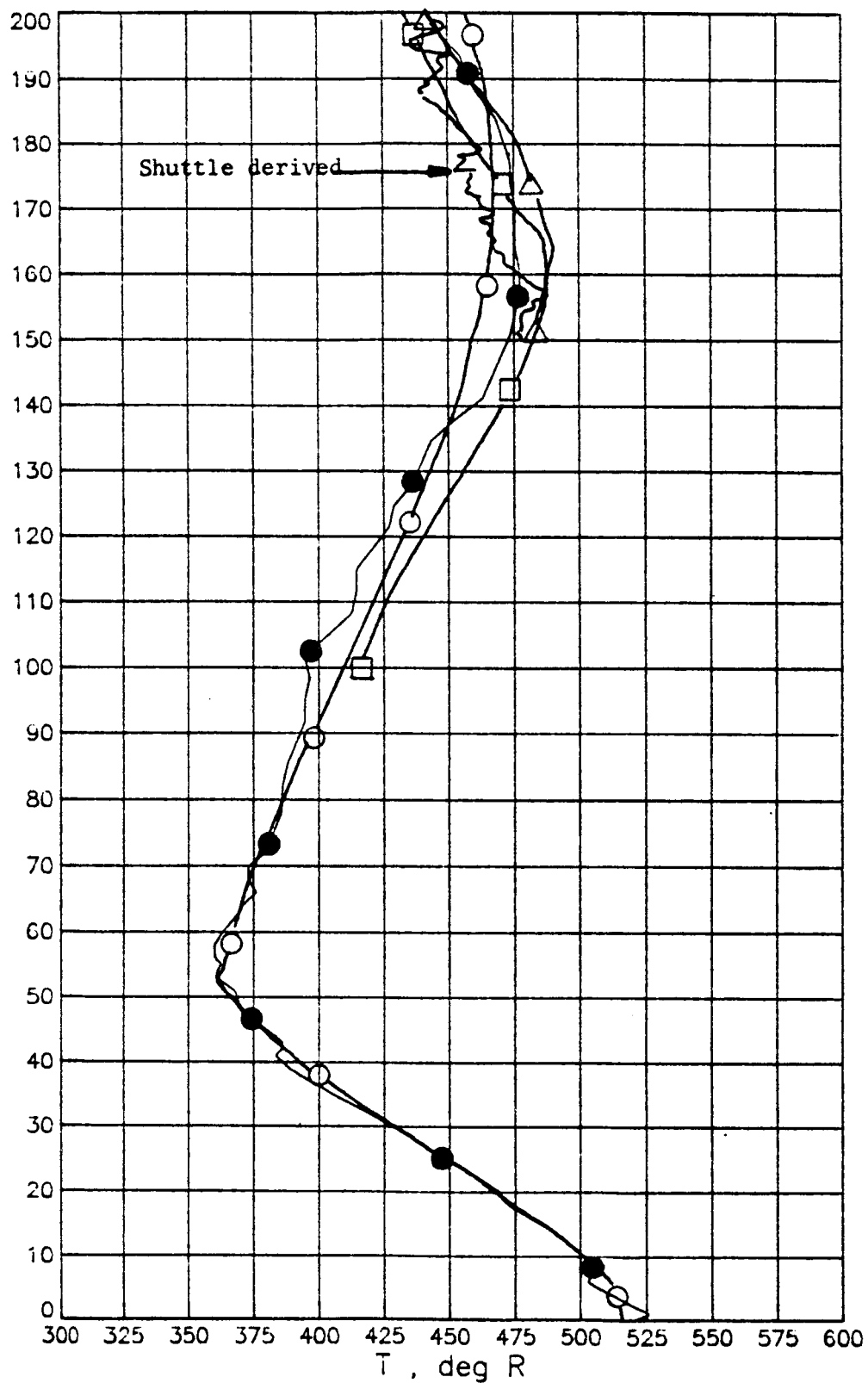


Fig. II-2 (concluded)

h , kft

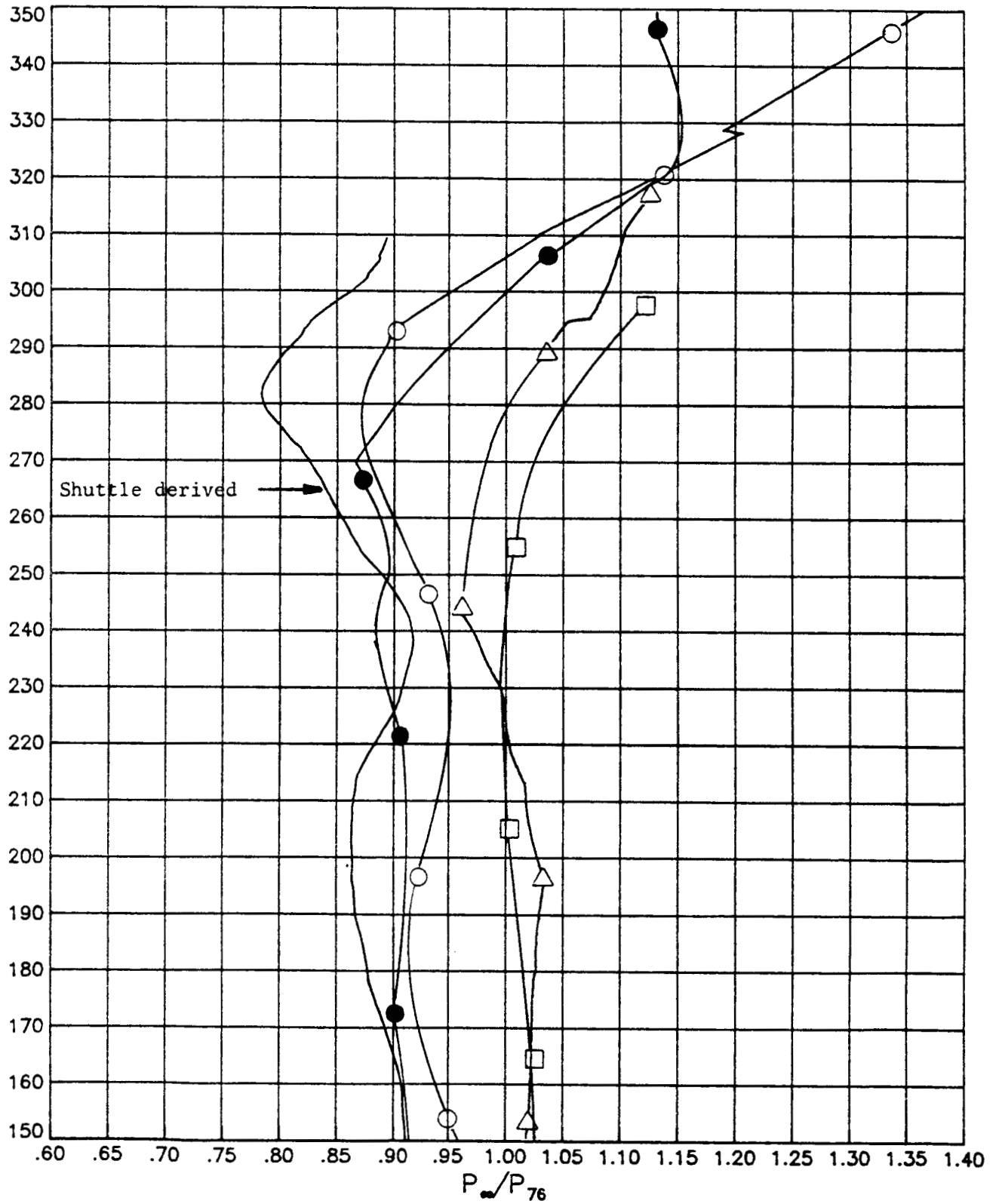


Fig. II-3 STS-19 (51-A) pressure comparisons

h , kft

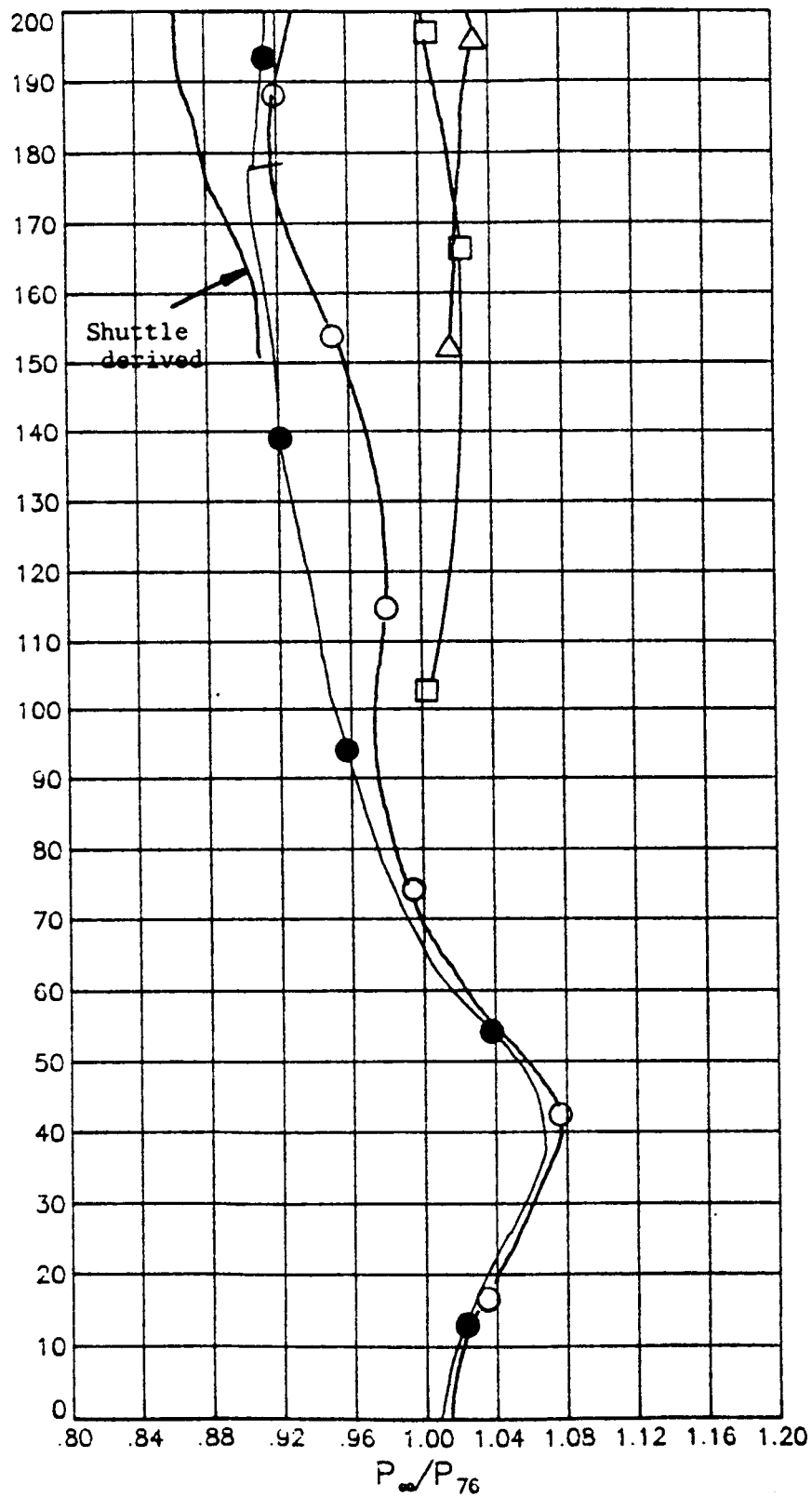


Fig. II-3 (concluded)

h , kft

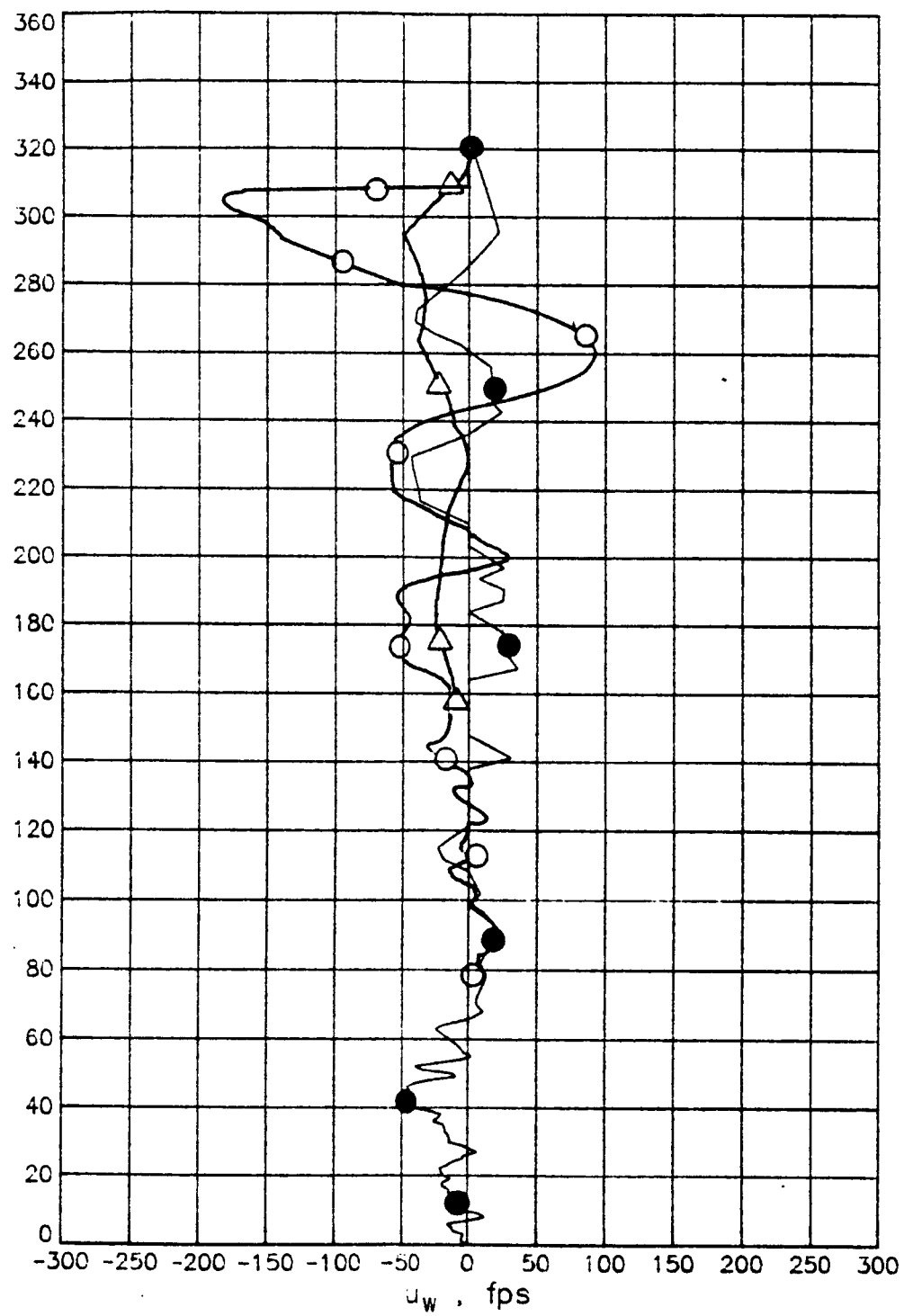


Figure II-4 North-South wind comparisons for STS-19

h , kft

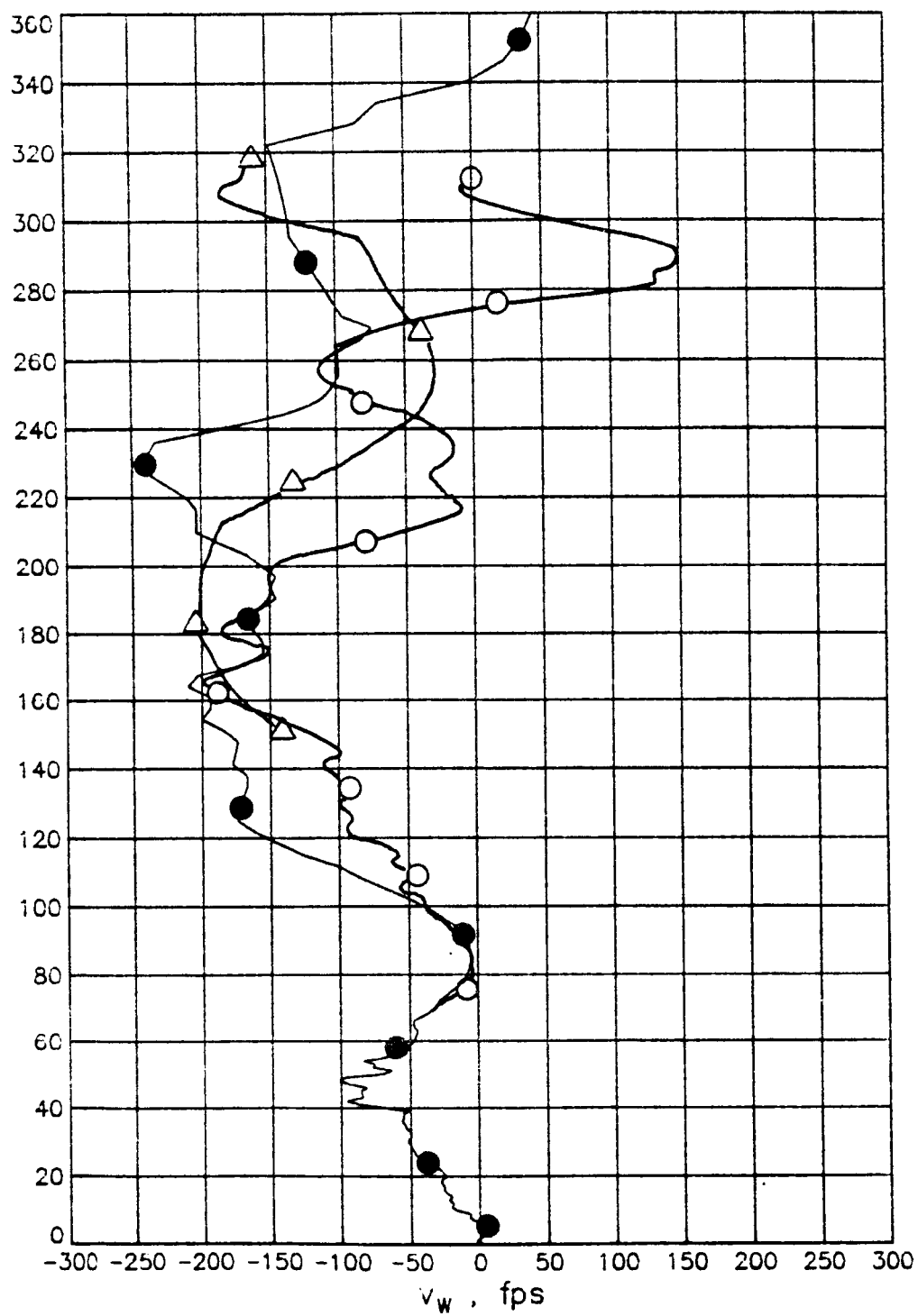


Figure II-5 East-West wind comparisons for STS-19

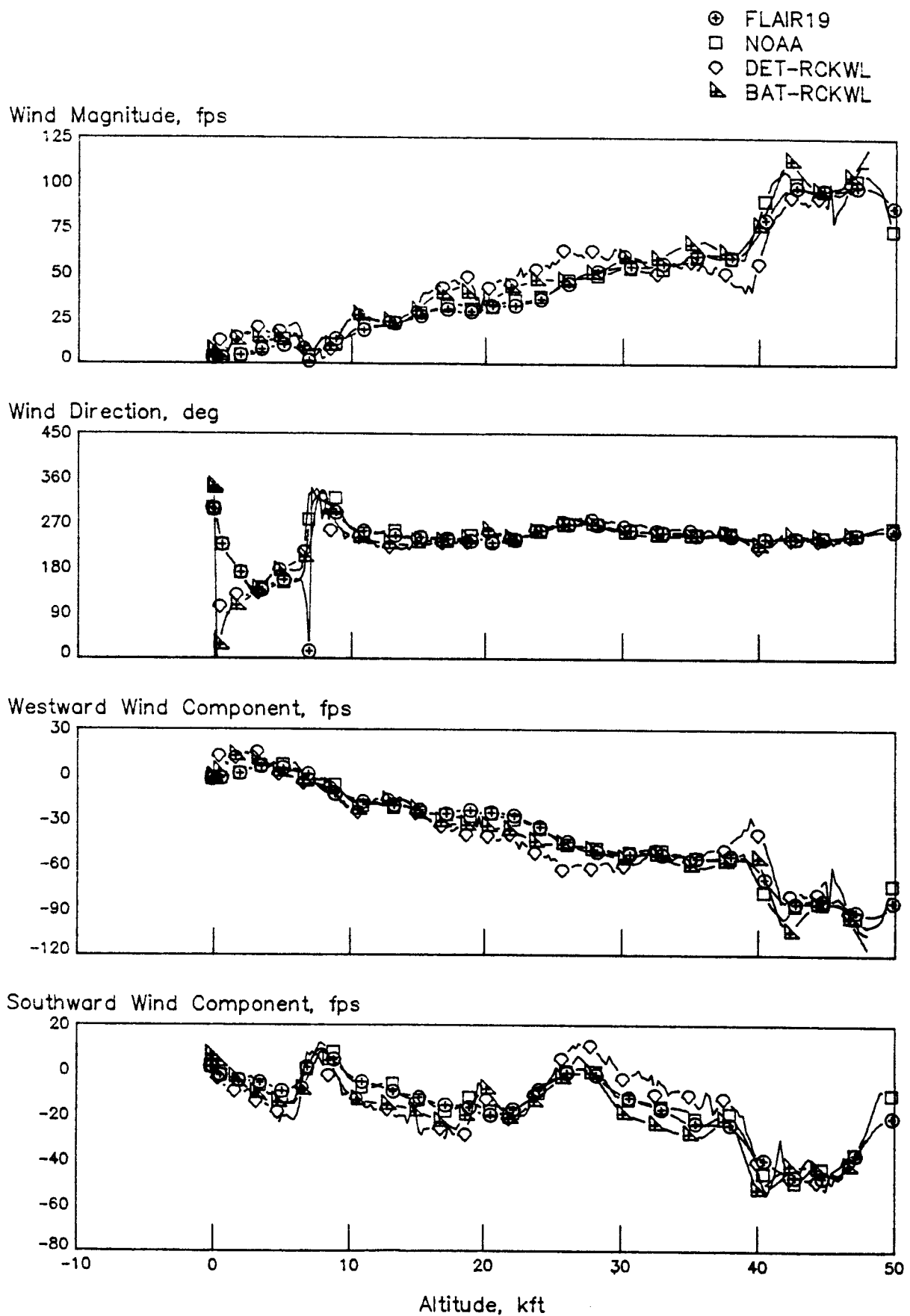


Fig. II-6. STS-19 Measured and Derived Winds

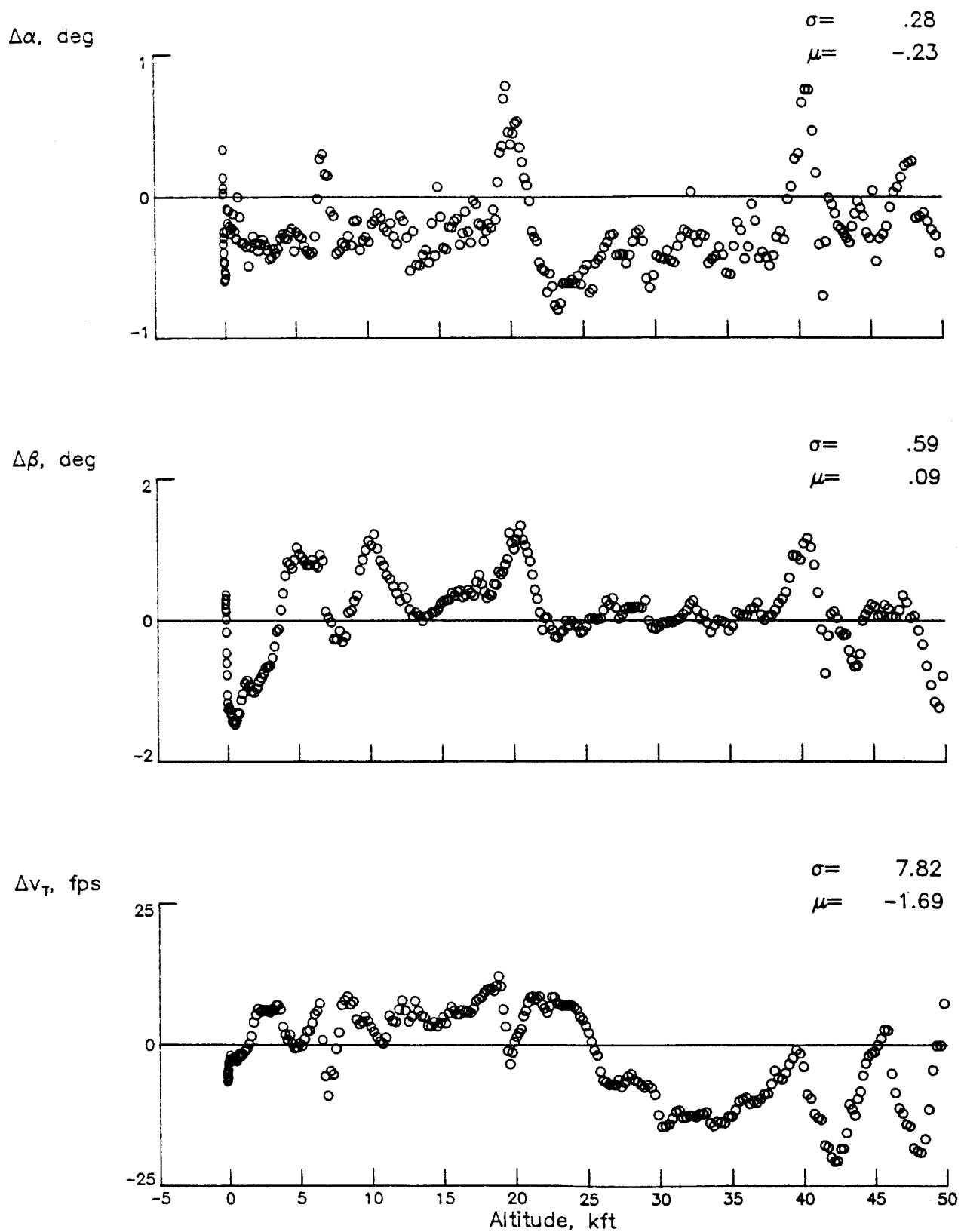


Fig. II-7. STS-19 ADP Differences, ST19ADS-ST19BET

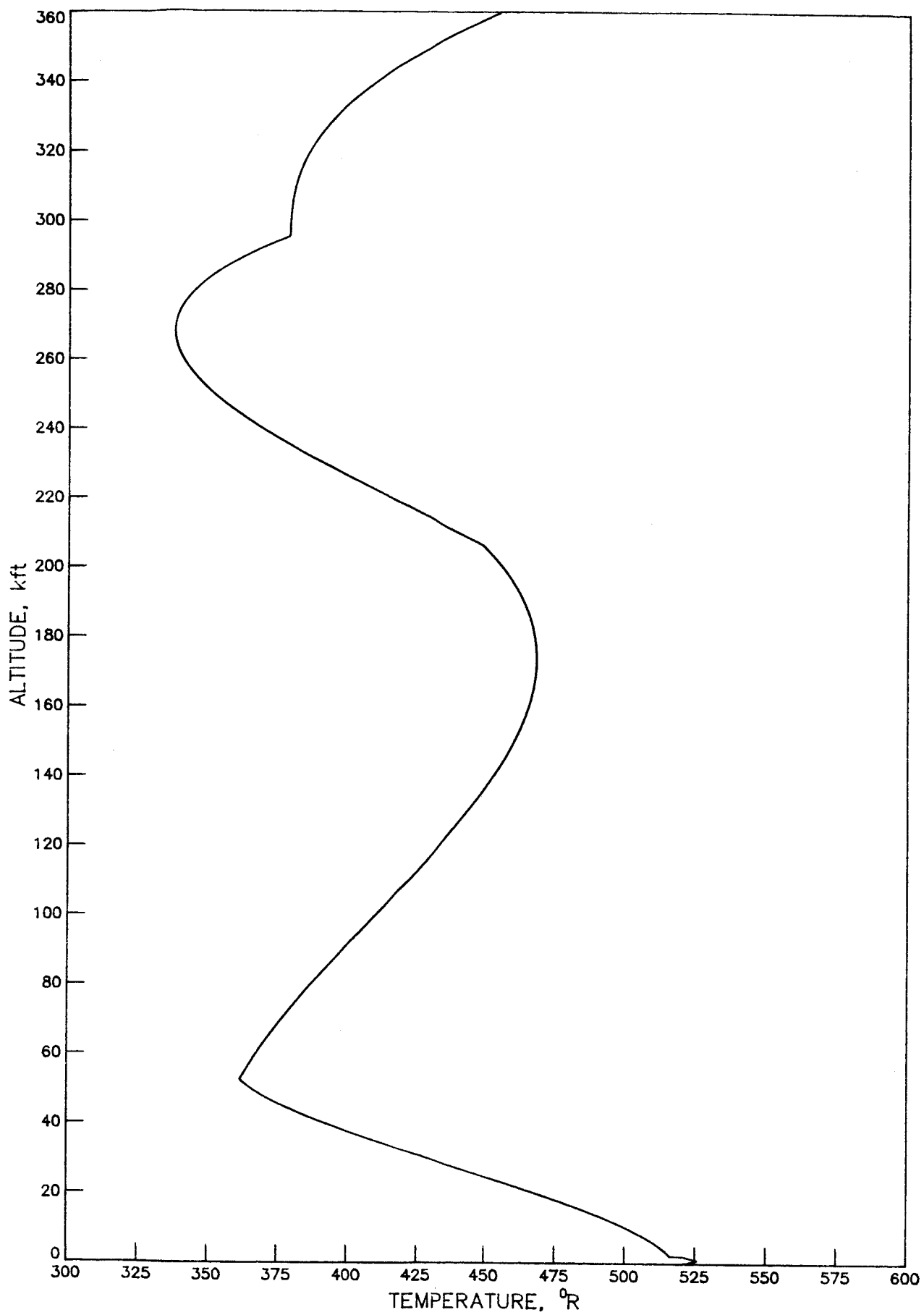


Figure II-8 Final temperature profile for STS-19 (51-A)

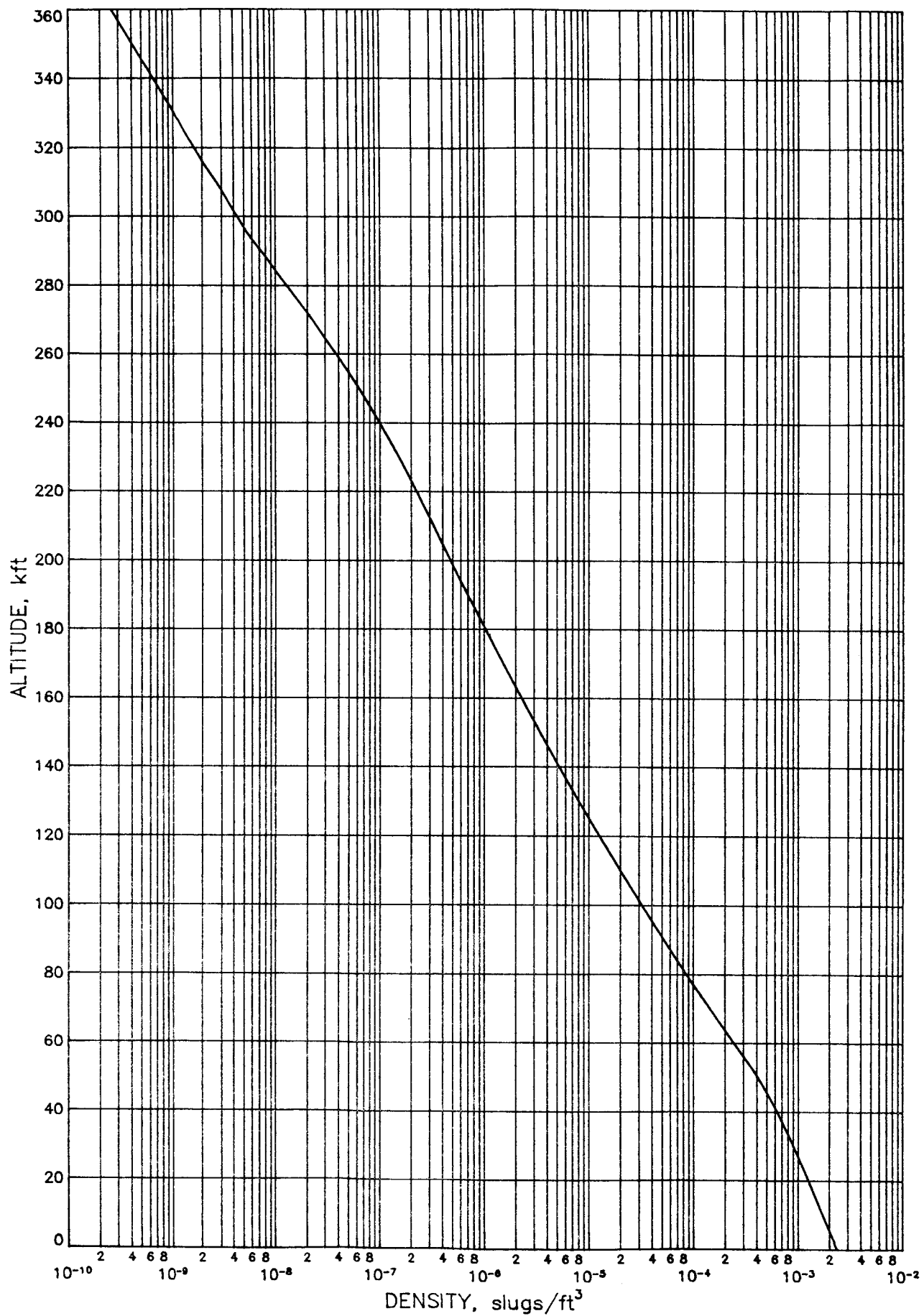


Figure II-9 Final density profile for STS-19 (51-A)

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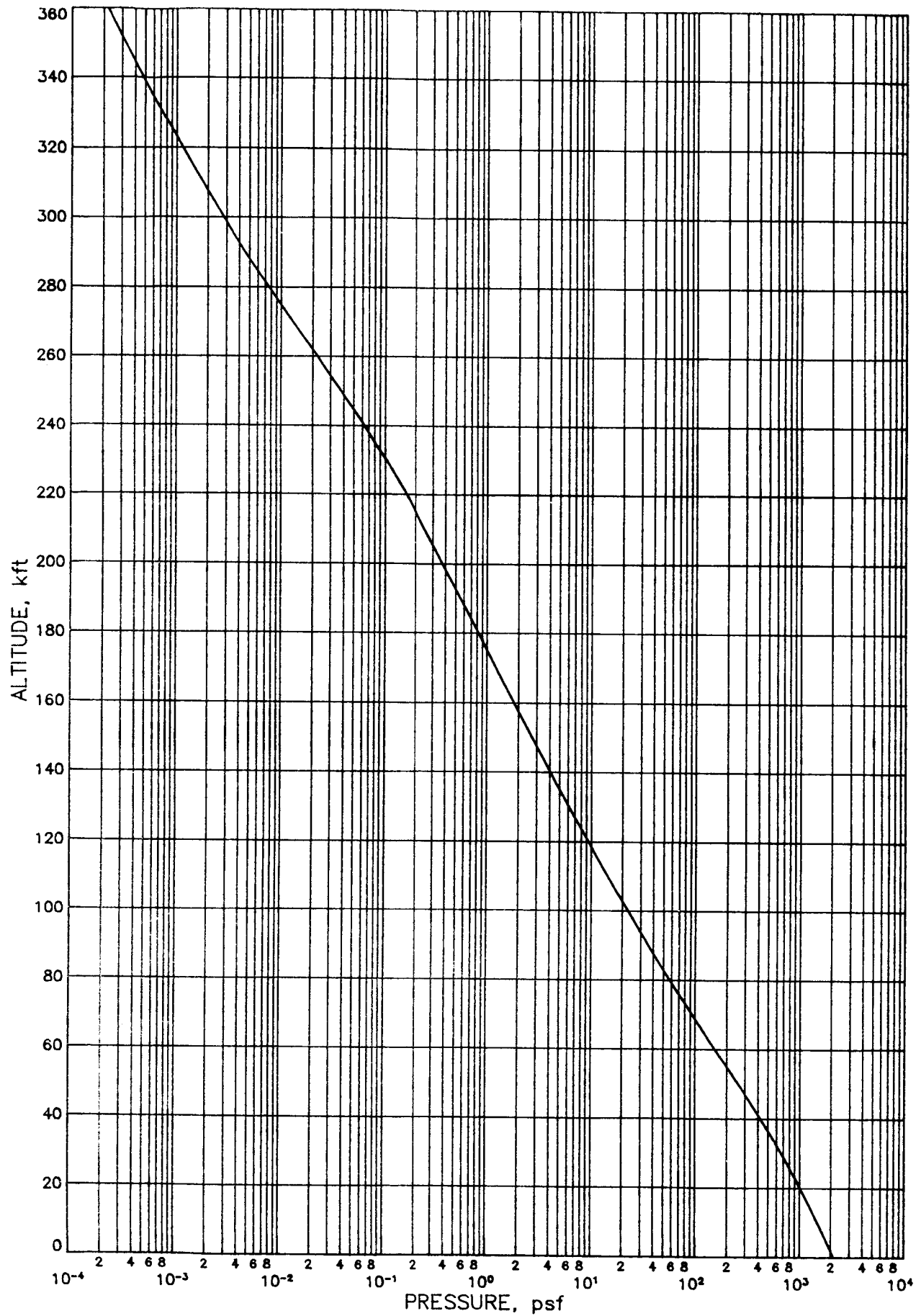


Figure II-10 Final pressure profile for STS-19 (51-A)

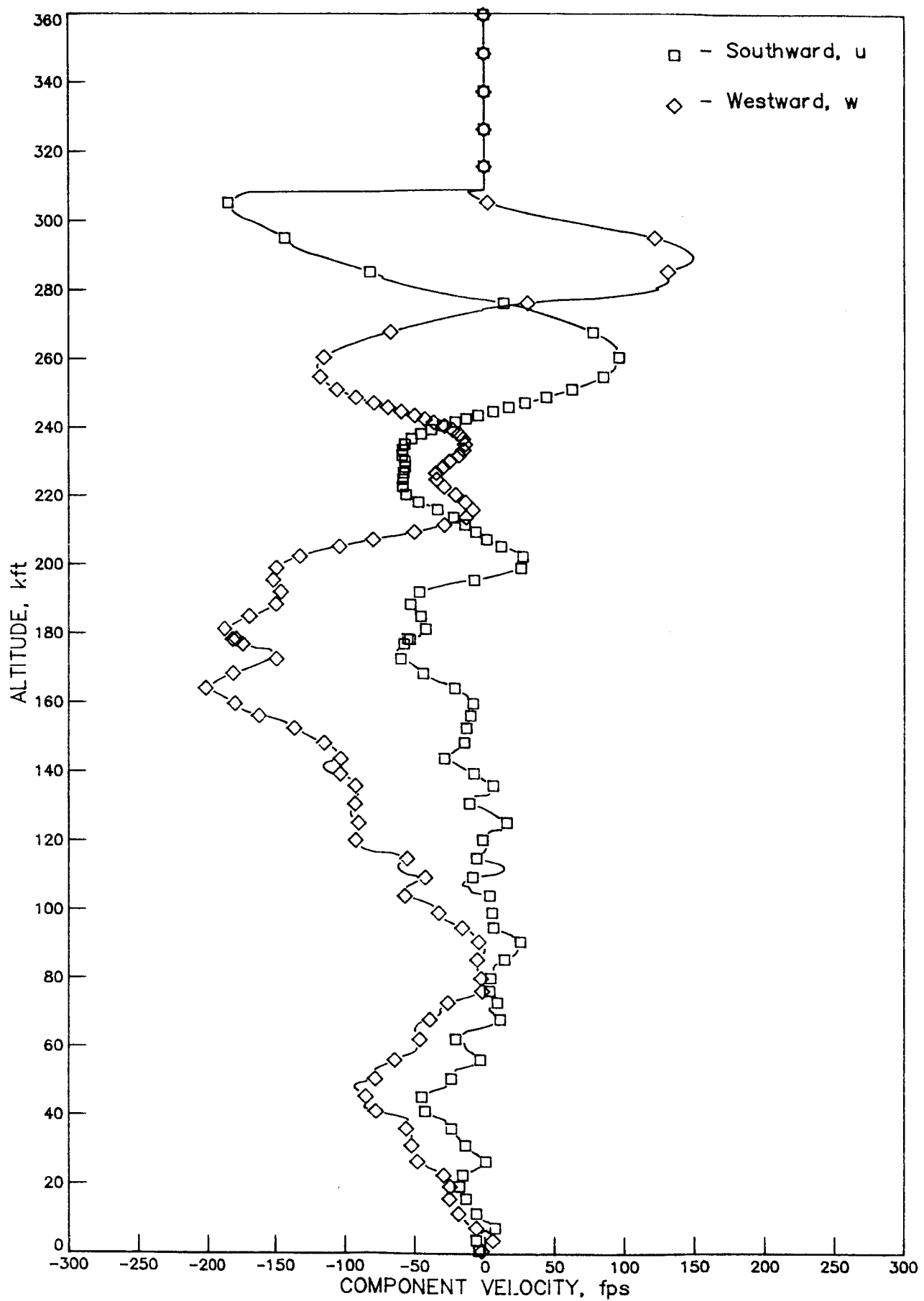


Figure II-11 Final atmospheric winds for STS-19 (51-A)

Section III. Aerodynamic BET development and summary results

This section summarizes the STS-19 aerodynamic results. These data were plotted from the primary AEROBET generated for this flight, namely, NK0165. These data were generated based on the previously discussed inertial BET and the selected atmosphere. OI data defining RCS and control surface deflections were obtained from NK0785, thinned to 1 Hz and output on reel NP0302. Mass properties utilized are given in Appendix A.

Altitude, altitude rate, dynamic pressure, and Mach number are plotted as Figures III-1 through III-4, respectively. Each are plotted versus time from epoch, with the latter three variables plotted versus altitude as well. The hypersonic viscous parameter is plotted versus altitude in Figure III-5 as is Reynolds number in Figure III-6. Air relative attitude angles; angle-of-attack, side-slip angle, and roll angle are presented versus Mach and altitude in the next two figures. The plot versus Mach number, Figure III-7, shows thereon (as a shaded region) the range of α 's flown on the previous flights.

Strip charts of the spacecraft dynamics versus Mach number are next presented (see Figure III-9).

Control surface deflections versus Mach and altitude as well as RCS activity versus Mach are shown in the next three figures. Again, Figure III-10, the plot vs. Mach, shows the previous range of control surfaces available. The additional elevon opportunities available with this flight are visible by inspection.

Figures III-13 and III-14 show the very interesting flight/data base comparison results for this mission. Again, shading is superimposed to show previous history, in this sense from a statistical perspective. The shading reflects a $\pm 1\sigma$ band around the mean prediction error computed from the ensemble flights. It is noted that the larger overprediction suggested around Mach 7 conforms to the 150 kft region discussed earlier as a potential problem area. The other obvious departure suggested near Mach 21 occurs at $h \sim 220$ kft and would be virtually identical no matter which remote atmosphere were selected. This does not imply that the discrepancy is not atmospheric in origin.

The pitching moment difference curve required increased scales to avoid saturation on the plot in view of the (rather) large discrepancy with respect to the data base. This was only true when plotted as a percentage difference in the 65% reference, not when

presented in the flight c.g. (Figure III-15). This also had to be done for STS-17 which heretofore governed the most negative (upward) hypersonic elevon setting. Consequently, that flight also had been the most forward c.g. flight until STS-19. Thus, over the past two flights the forward c.g. envelope has increased by approximately 4-5 inches. This flight's longitudinal c.g. profile versus Mach is shown as the last figure herein with the previous flights superimposed thereon.

h, kft

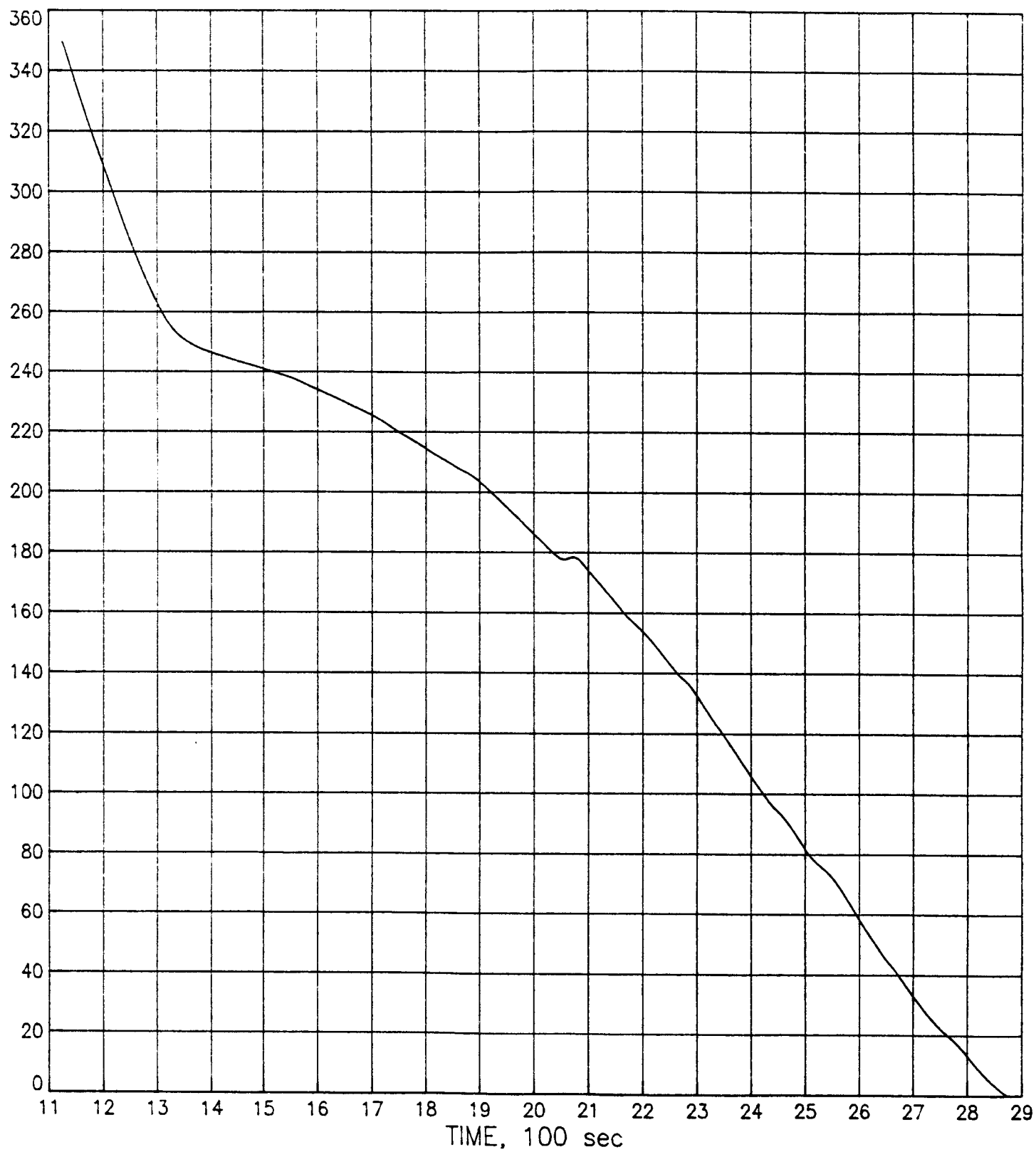
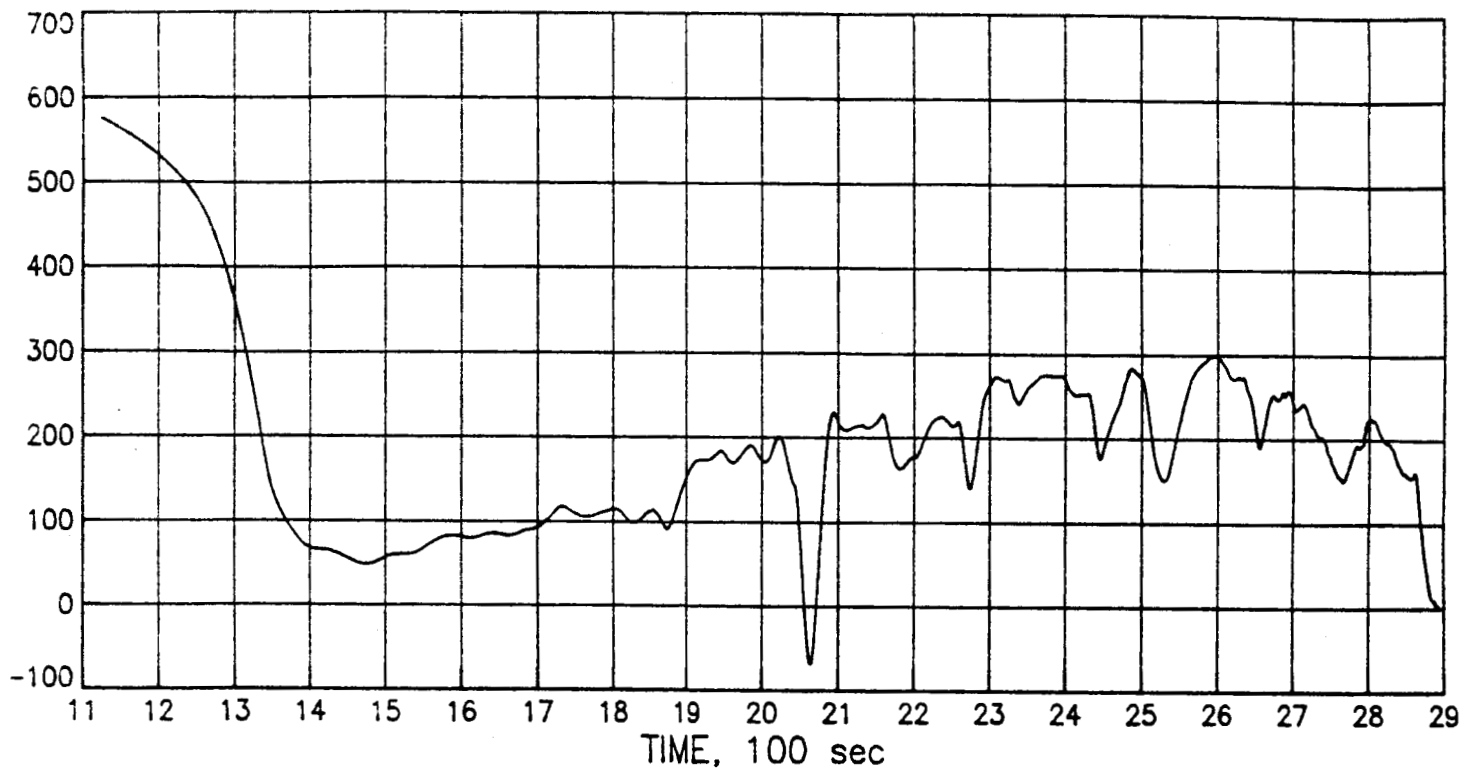


Figure III-1. STS-19 altitude time history

w , fps



w , fps

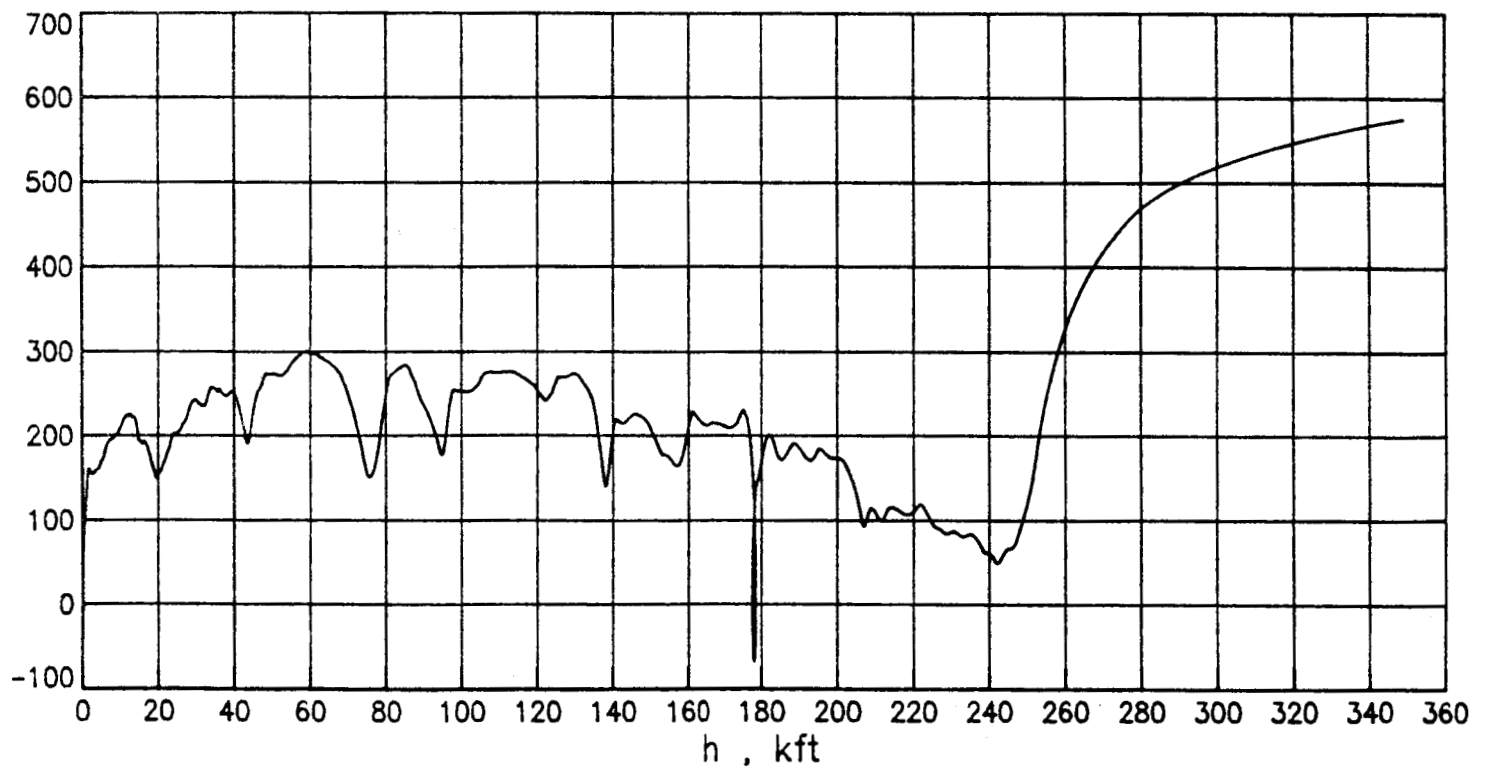
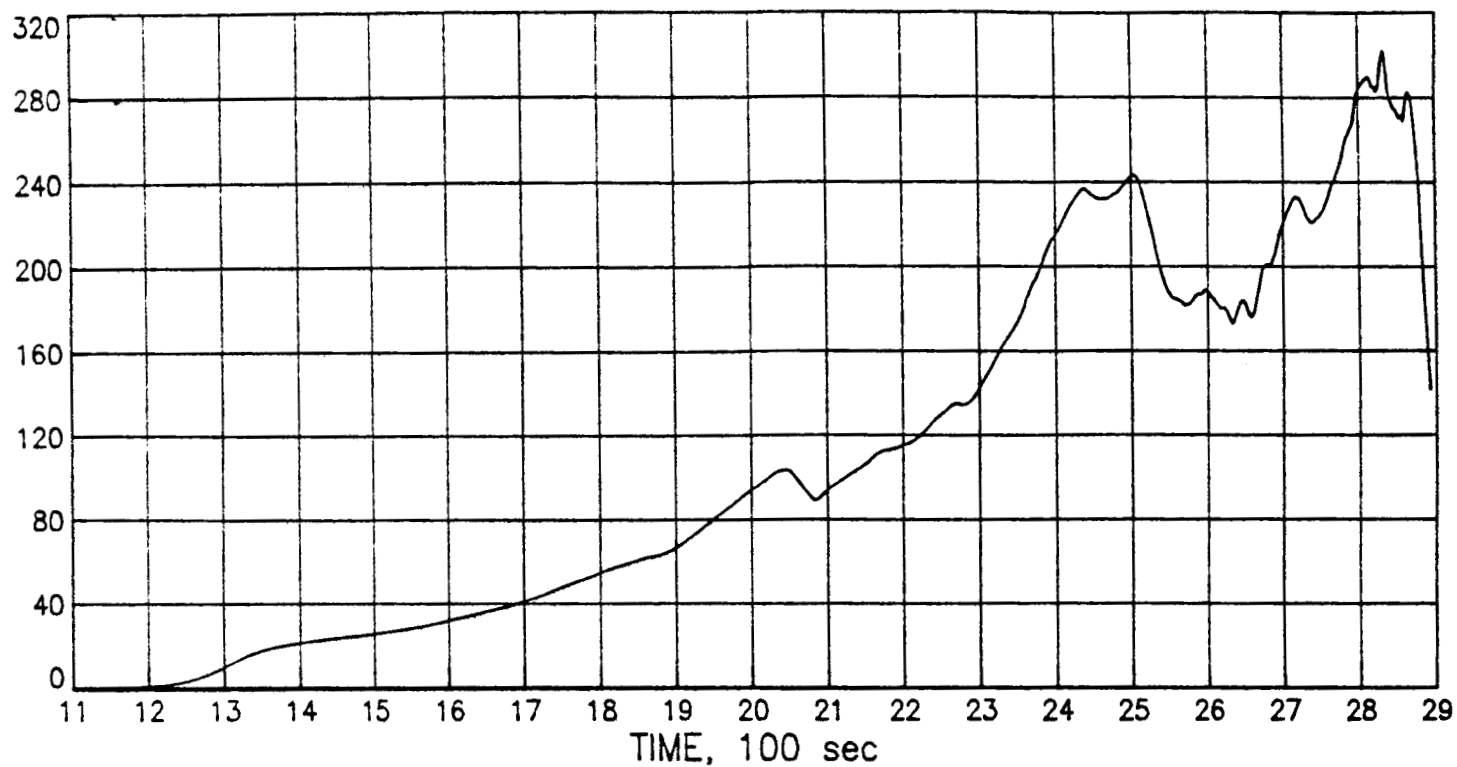


Figure III-2. STS-19 descent rate versus time and altitude

q , psf



q , psf

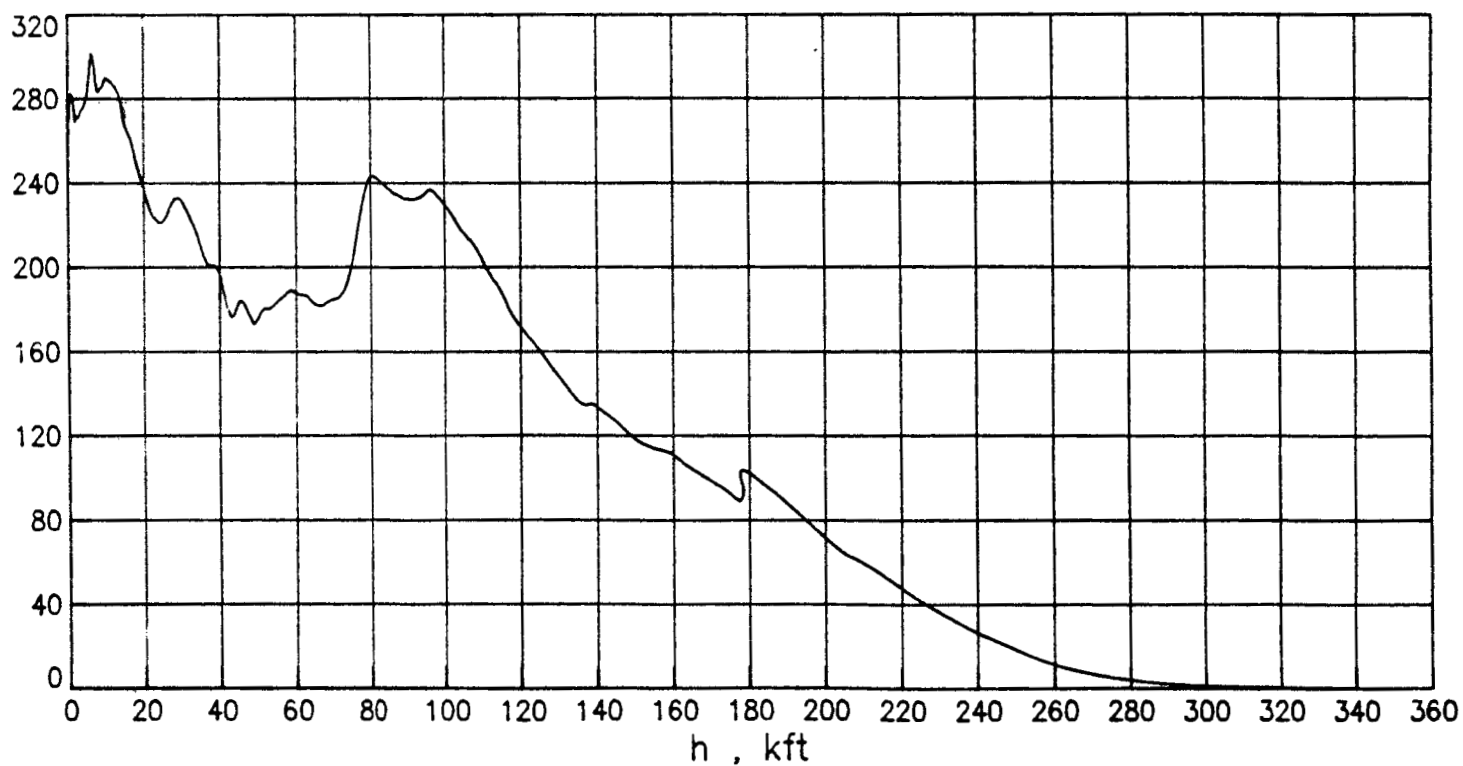
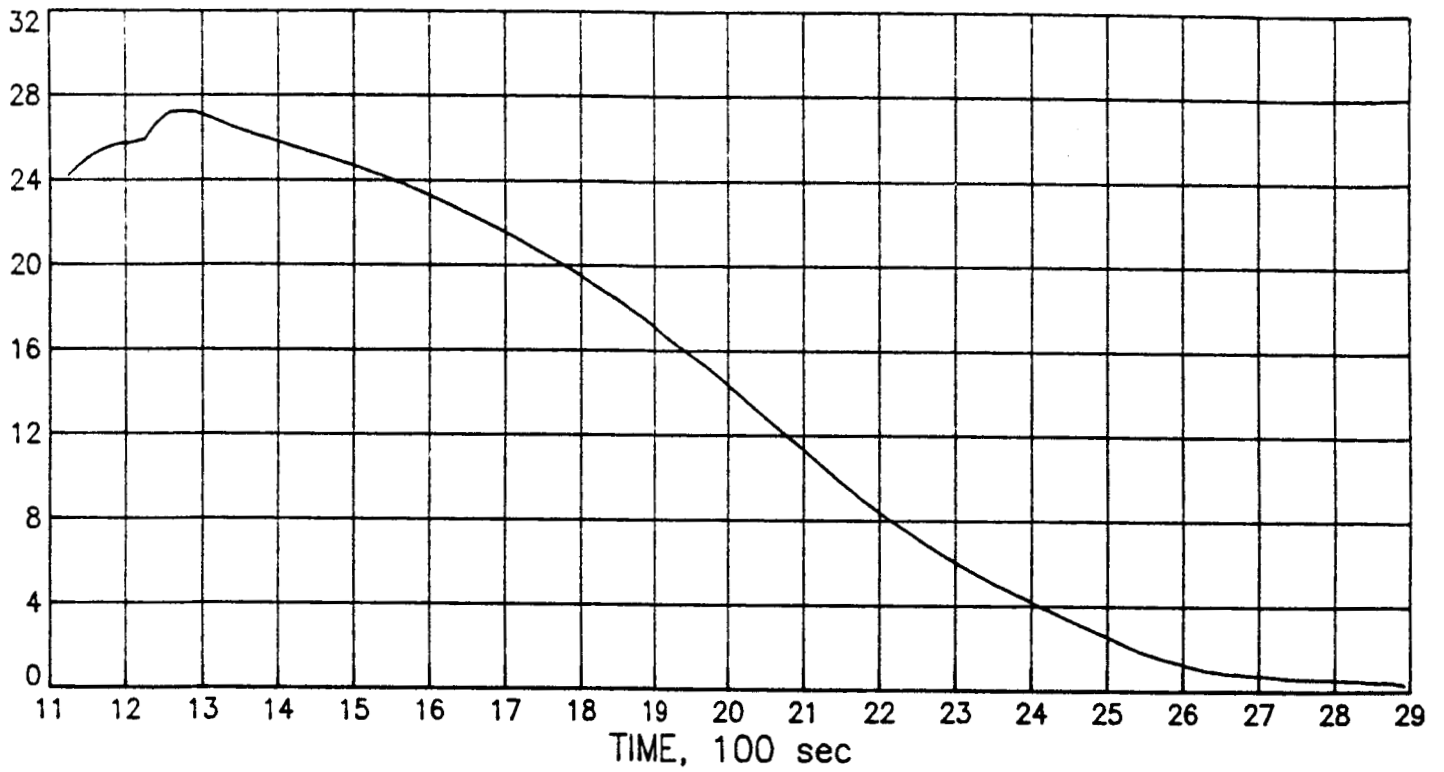


Figure III-3. STS-19 dynamic pressure vs. time and altitude

Mach



Mach

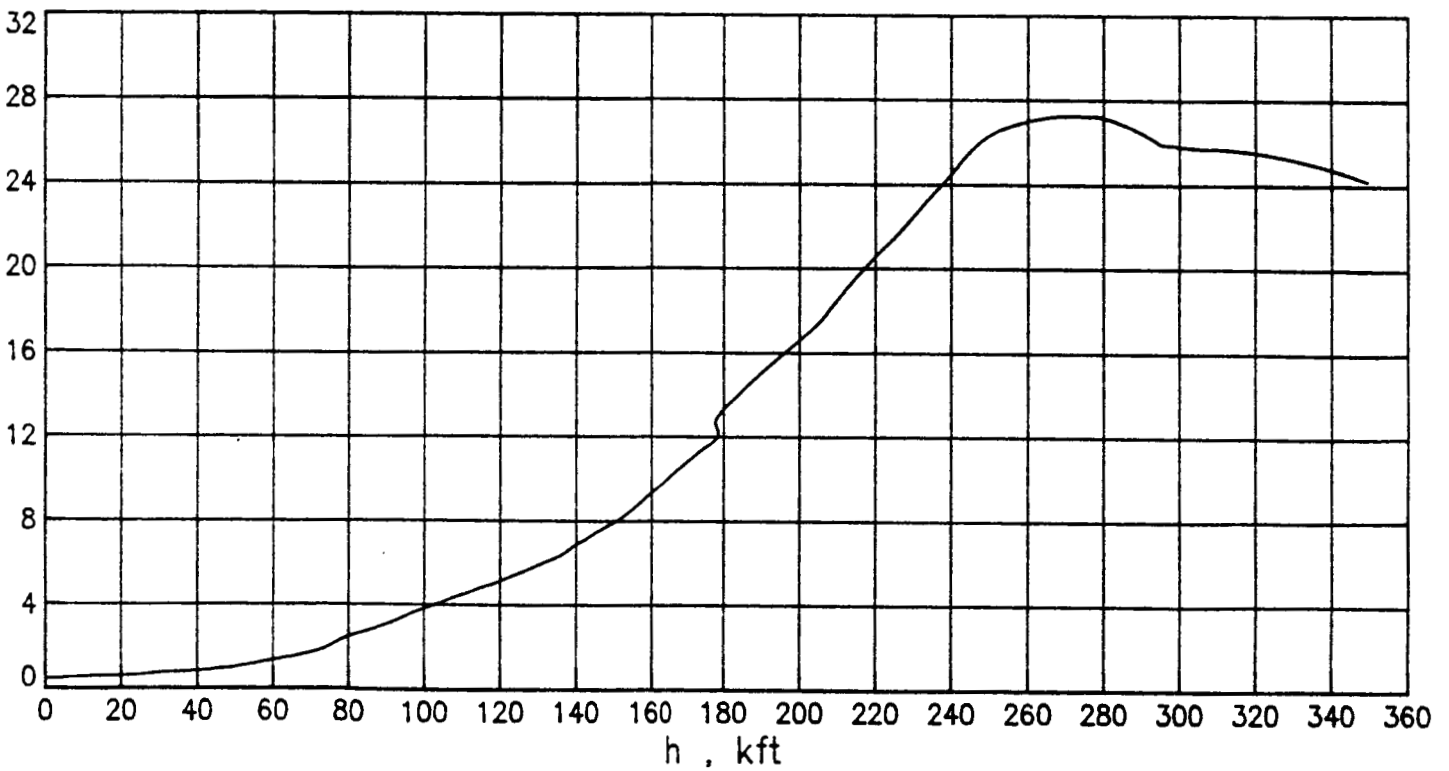


Figure III-4. STS-19 Mach number versus time and altitude

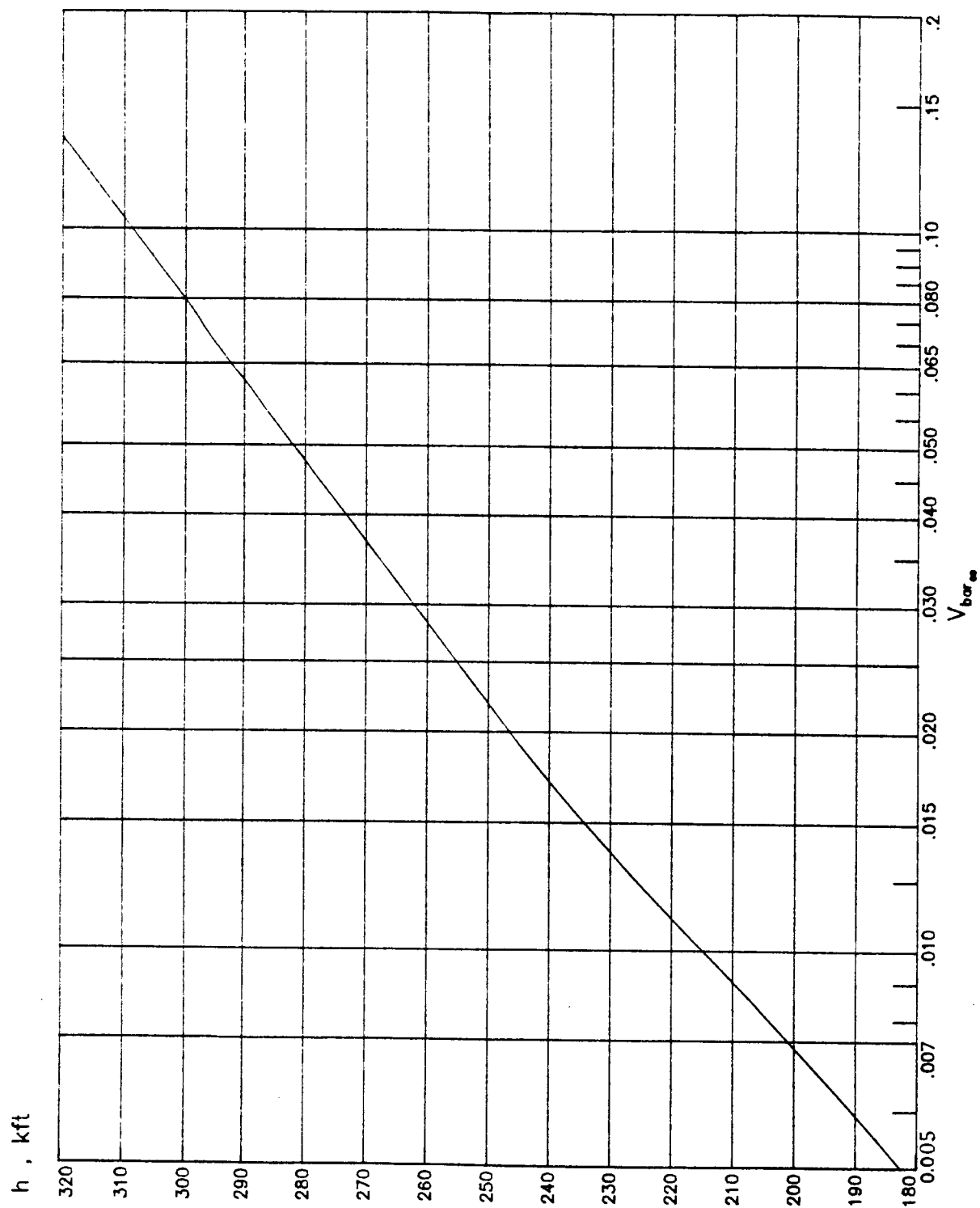


Figure III-5. STS-19 $V_{\bar{0}}$ versus altitude

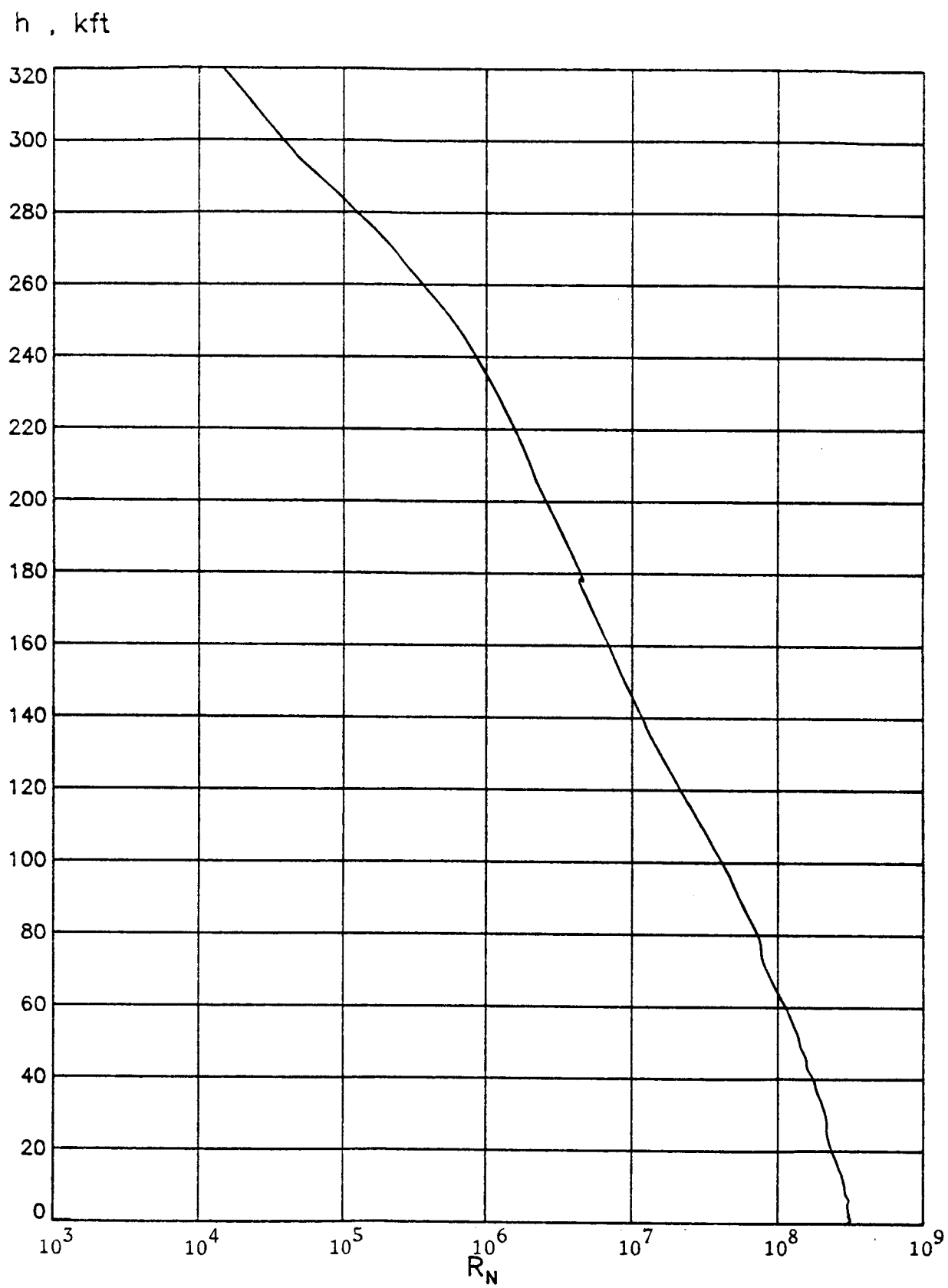
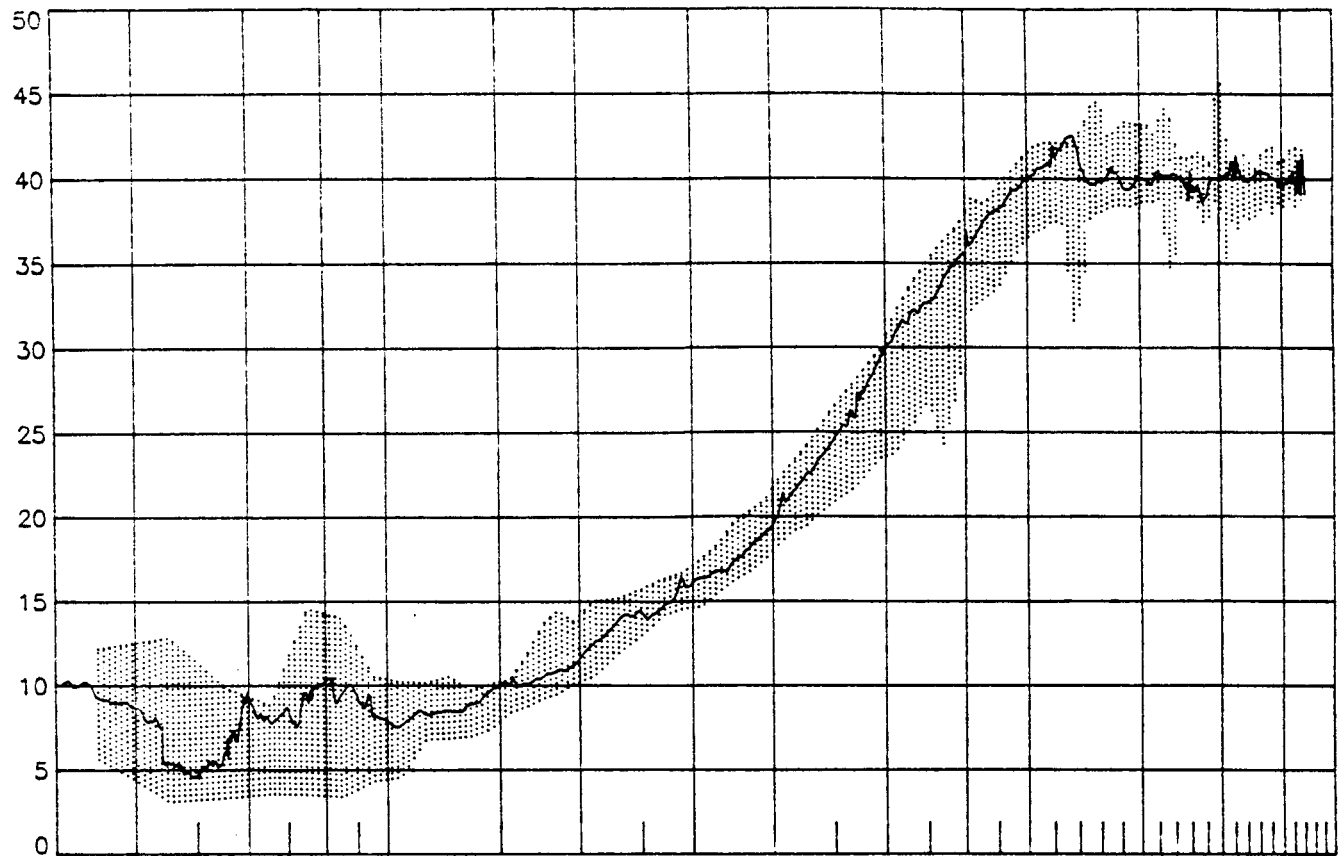
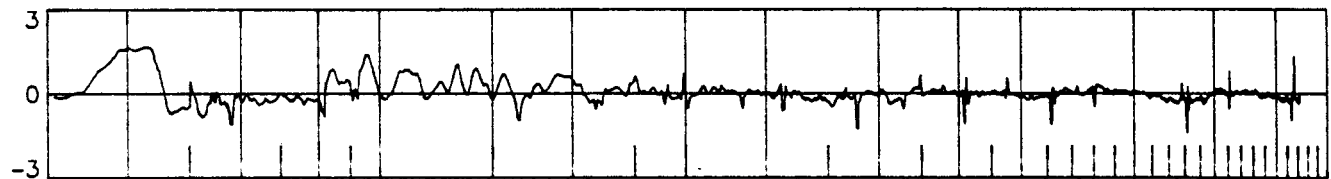


Figure III-6. STS-19 Rnum versus altitude

α , deg



β , deg



σ , deg

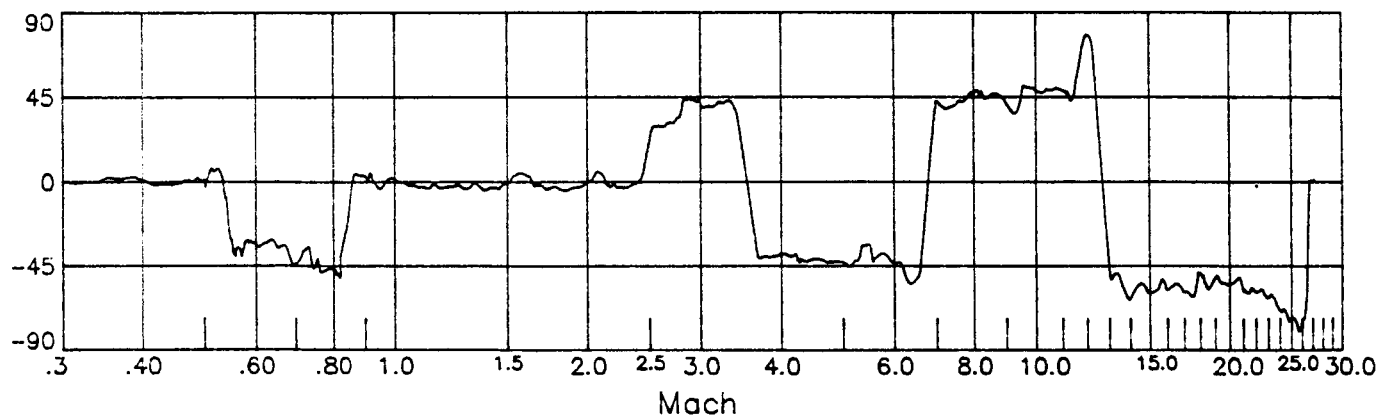


Figure III-7. STS-19 α , β and σ vs. Mach

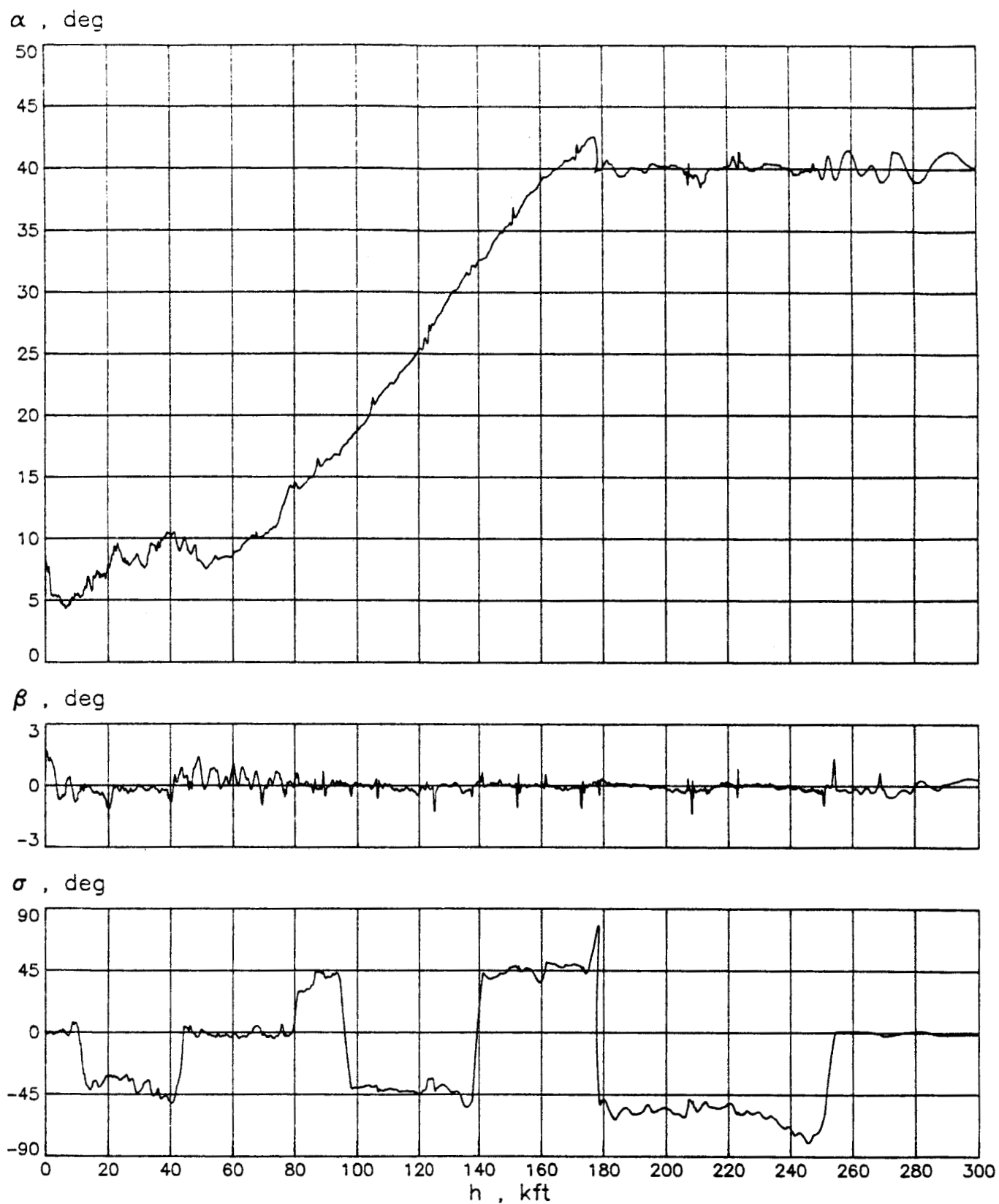


Figure III-8. STS-19 α , β and σ vs. h

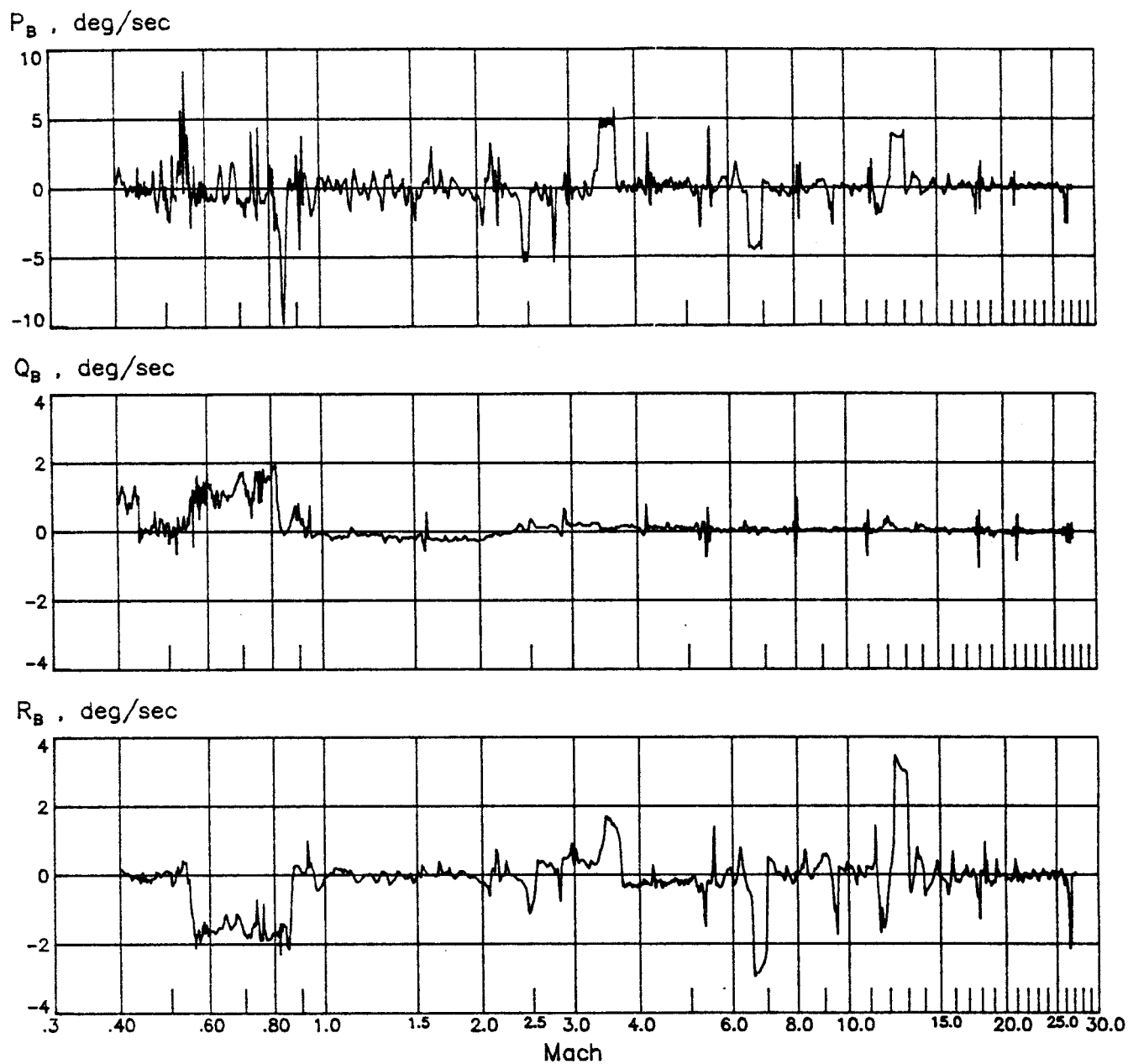


Figure III-9. STS-19 dynamic data vs. Mach

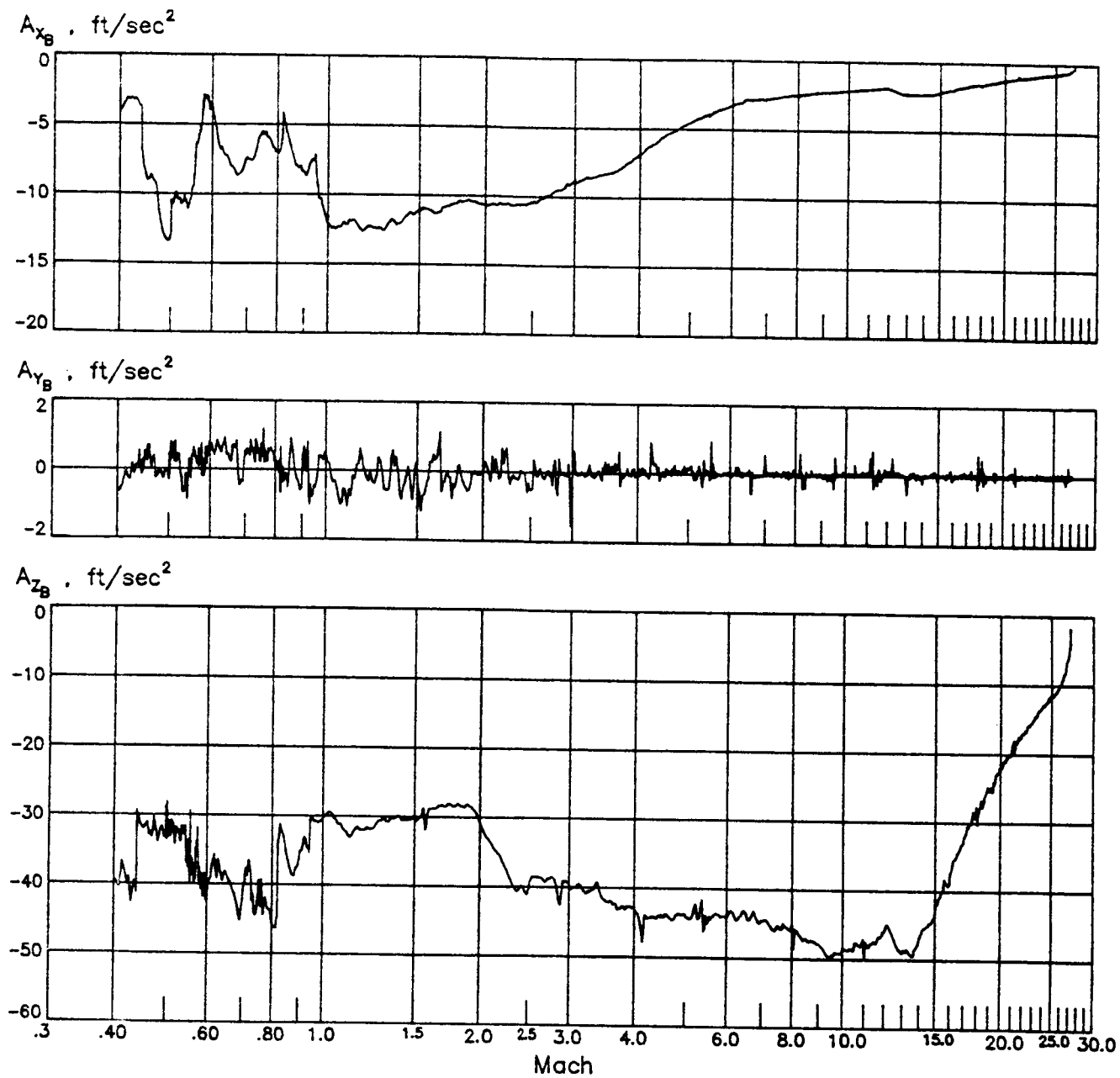


Figure III-9. (concluded)

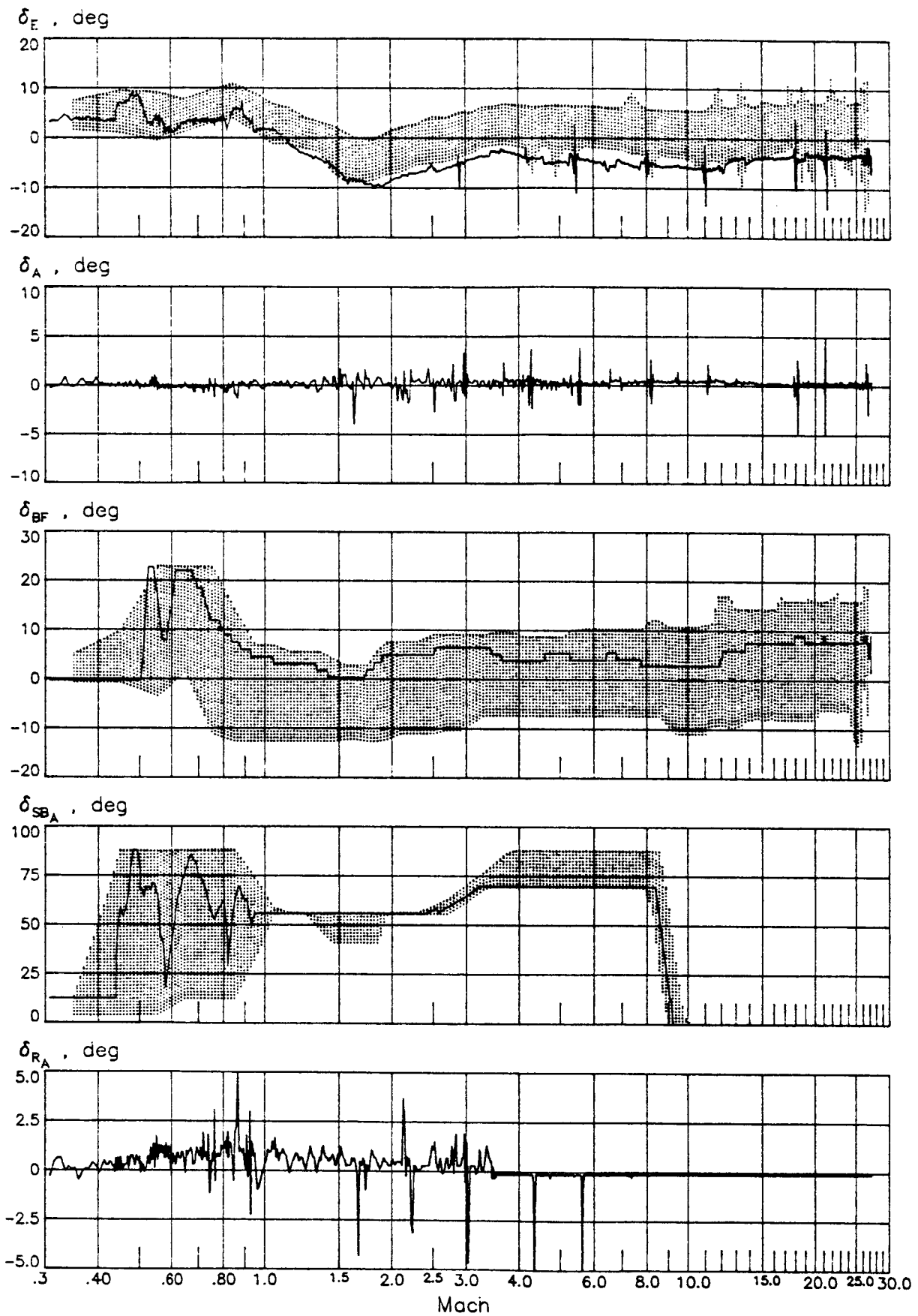


Figure III-10. STS-19 control surfaces vs. Mach

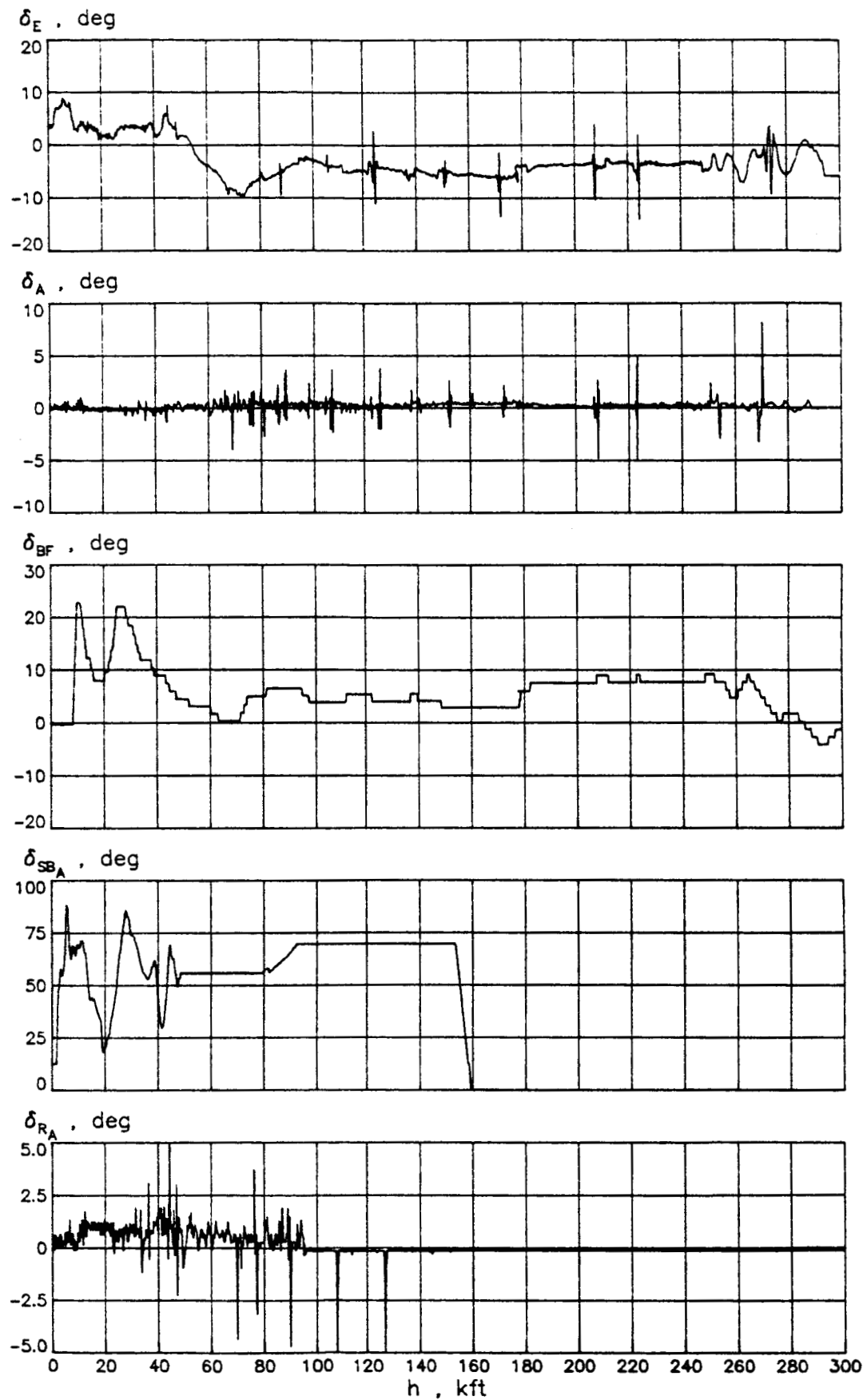
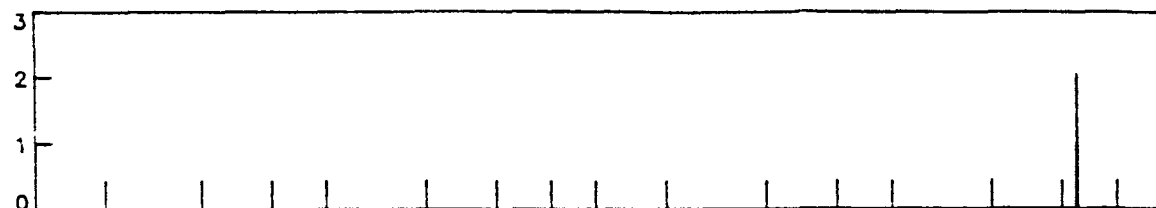
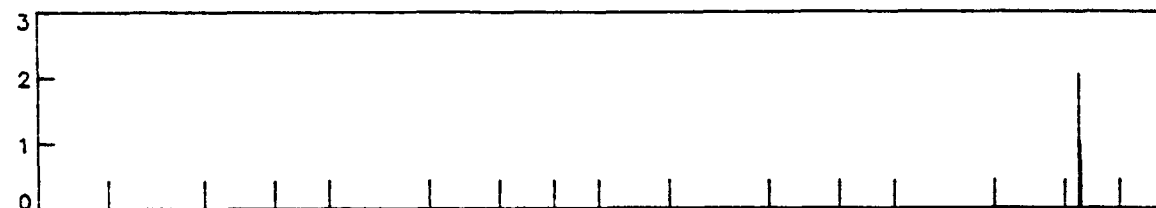


Figure III-11. STS-19 control surfaces vs. altitude

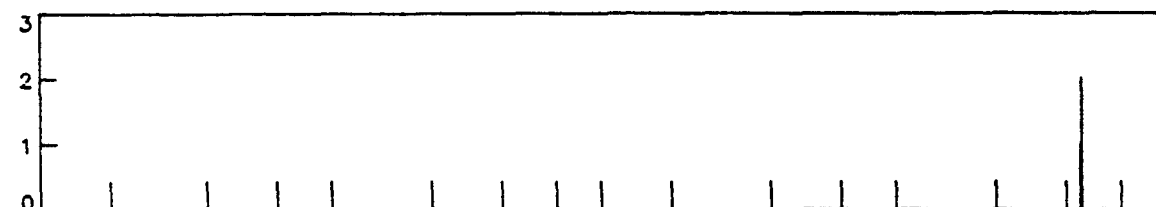
LHUF JETs



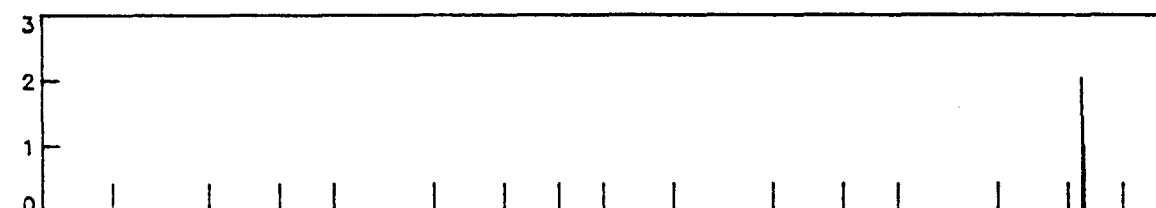
LHDF JETs



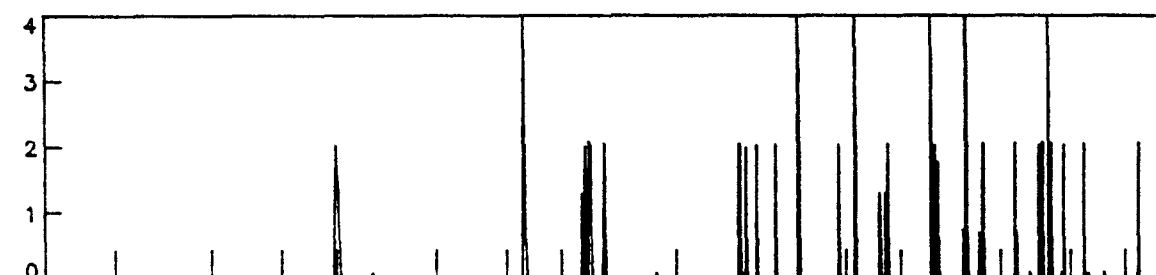
RHUF JETs



RHDF JETs



YAWP JETs



YAWN JETs

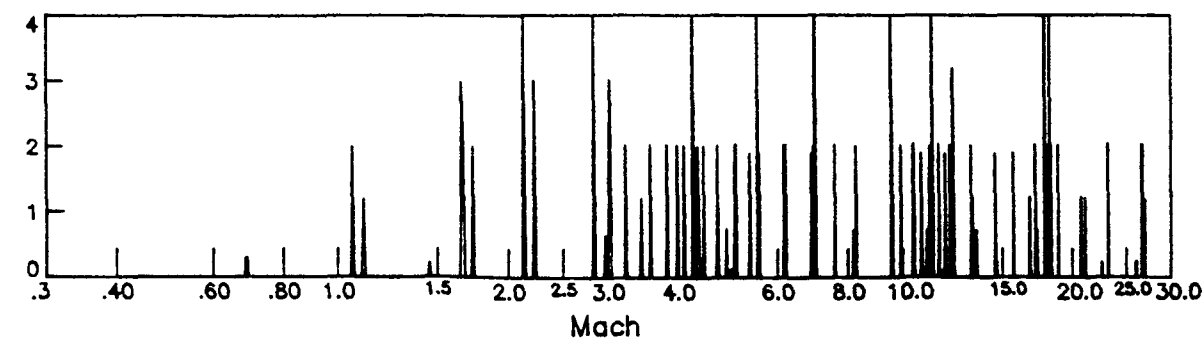


Figure III-12. STS-19 RCS firings vs. Mach

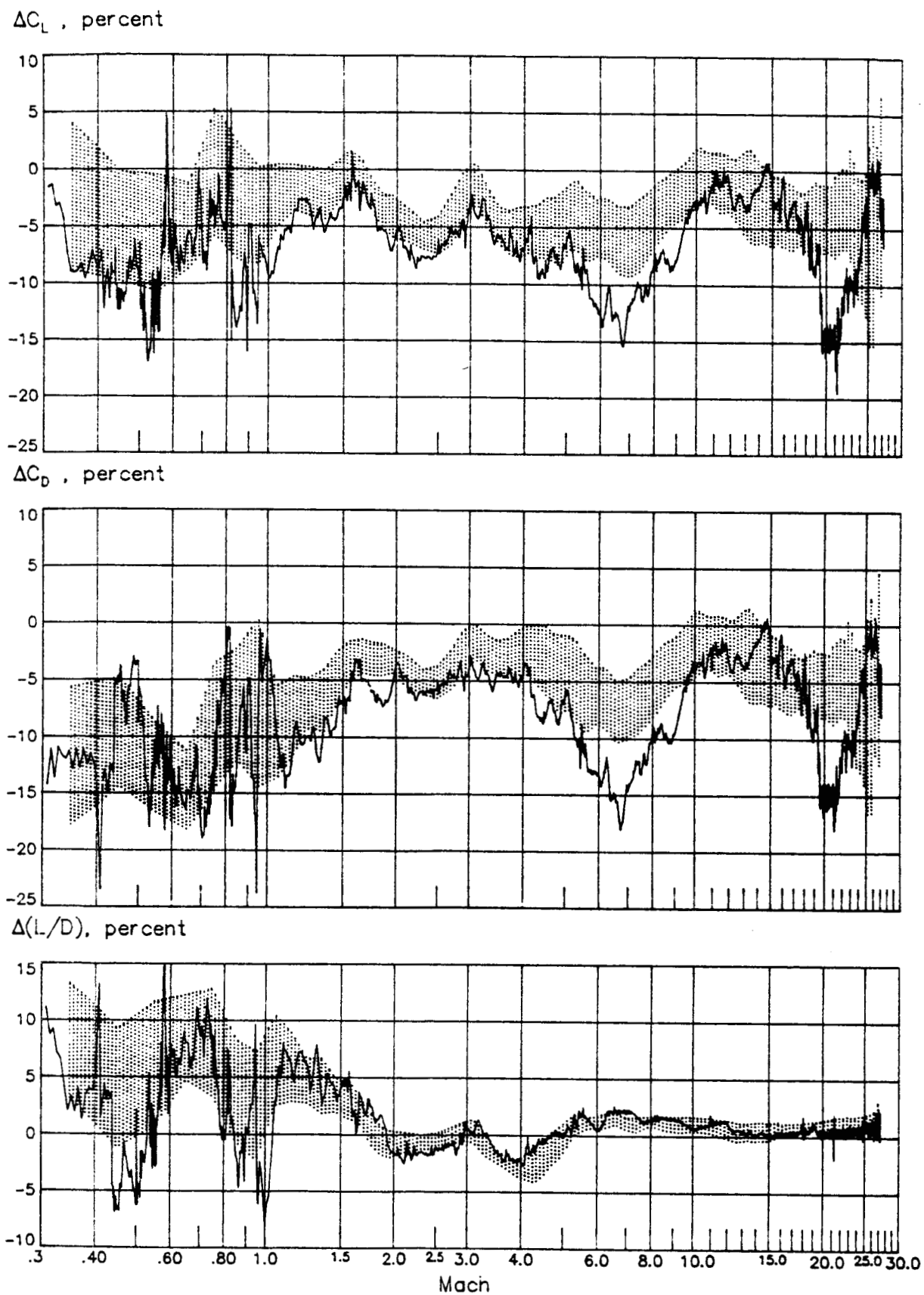


Figure III-13. STS-19 lift, drag, and L/D differences

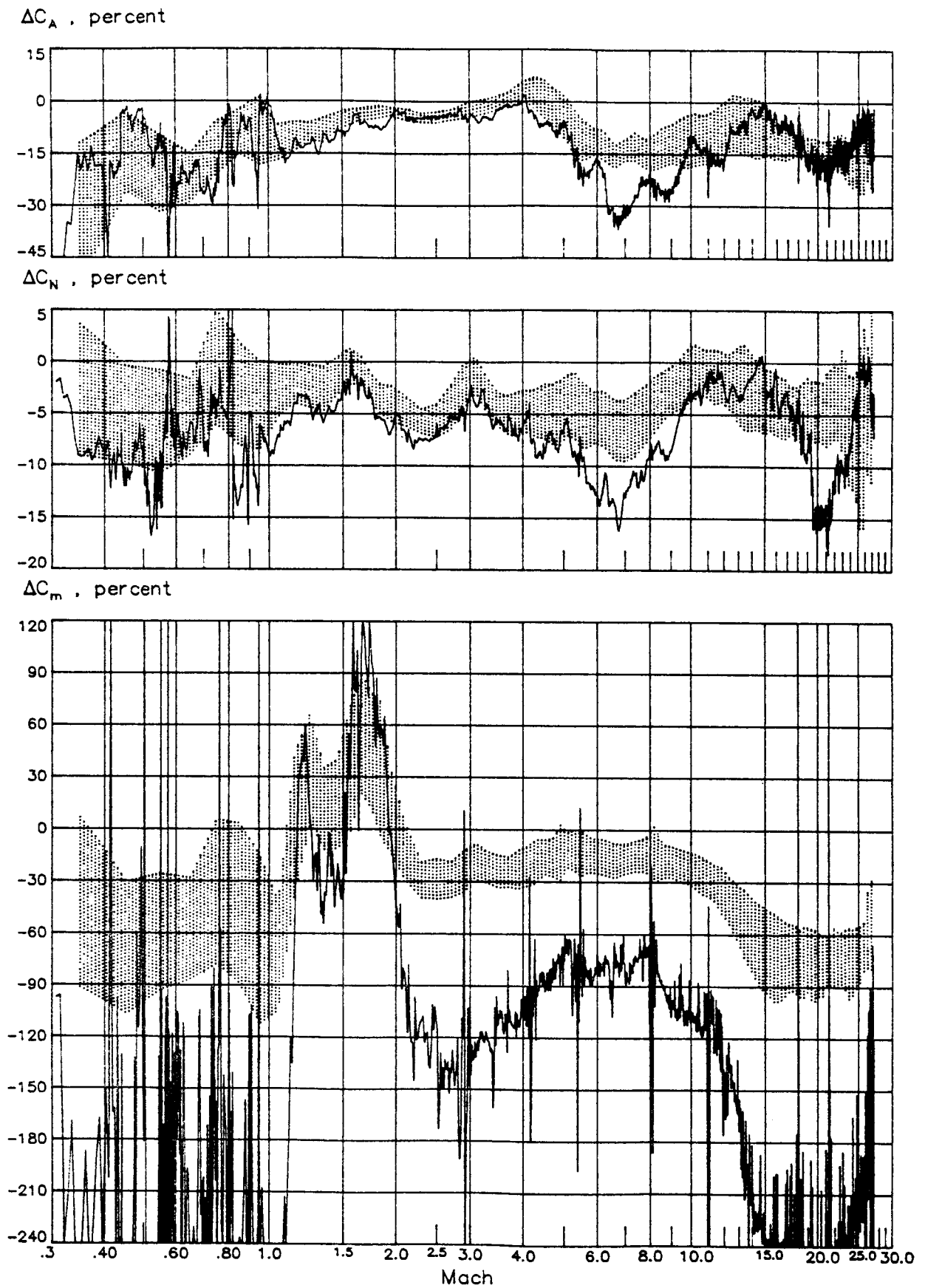


Figure III-14. STS-19 axial, normal, and moment differences

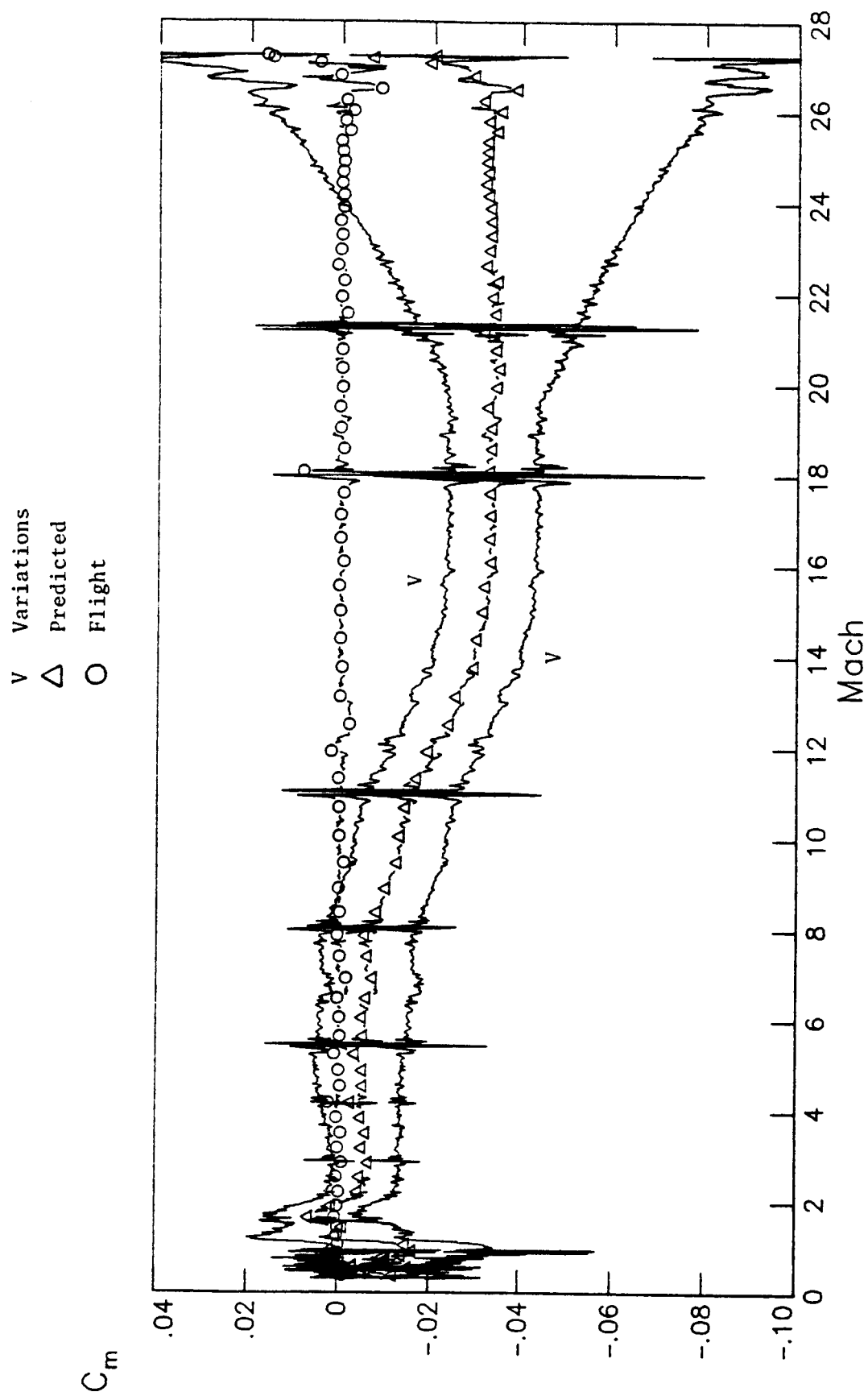


Figure III-15. STS-19 C_m comparisons vs. Mach

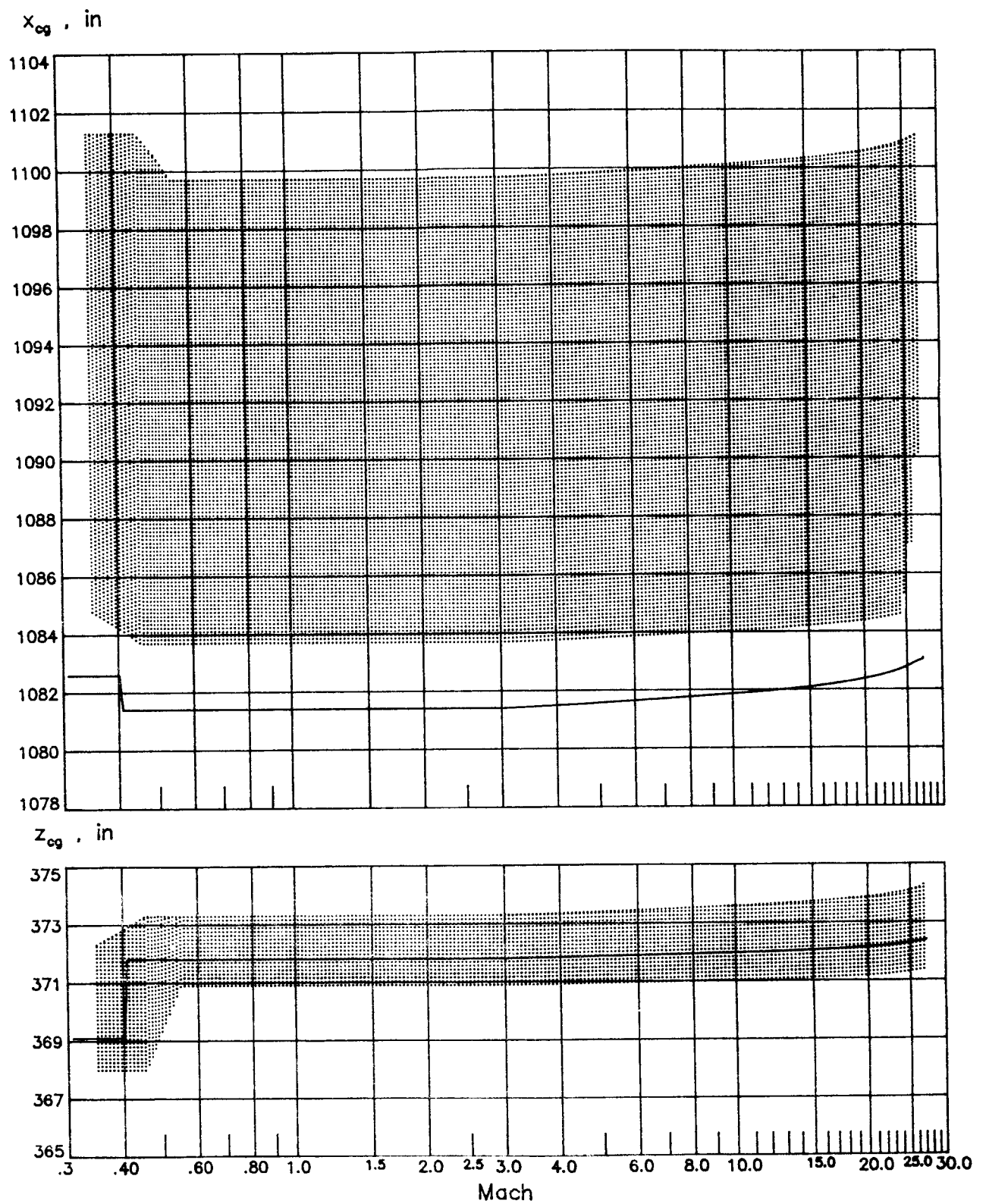


Figure III-16. STS-19(51-A) c.g. profiles vs. Mach

IV. MMLE input file generation

For this **Discovery** flight GTFILes were created using the only two possible sources of spacecraft dynamics, i.e., IMU and RGA/AA. The IMU GTFILe was output on reel NK0202. The RGA1/AA1 file was created by incorporating these channel 1 measurements as replacements to the IMU derived body axes components. The output reel for the RGA/AA file was NK0203. The RGA/AA data were calibrated versus the IMU measurements using the time interval biases shown in **Figure IV-1**. Maneuvers effected during the mission are as given in **Table IV**. Spacecraft mass properties are given in **Appendix A**.

LONGITUDINAL MANEUVERS

<u>START TIME</u>		<u>STOP TIME</u>	
H:M:S	Sec. from epoch	H:M:S	Sec. from epoch
11:32:47	1267	11:32:57	1277
11:40:11	1711	11:40:22	1722
11:42:39.5	1859.5	11:42:52	1872
11:46:48	2108	11:46:54	2114
11:48:30.5	2210.5	11:48:37	2217
11:50:24.5	2324.5	11:50:36	2336
11:51:39.5	2399.5	11:51:43	2403
11:52:57	2477	11:53:00	2480
11:54:26	2566	11:54:30	2570
11:55:46	2646	11:55:49	2649

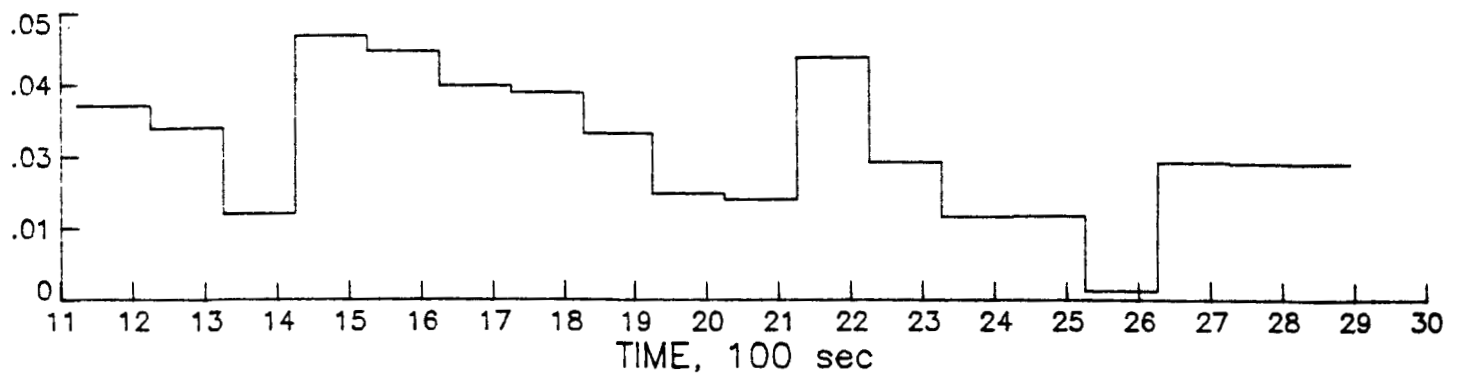
LATERAL DIRECTIONAL MANEUVERS

<u>START TIME</u>		<u>STOP TIME</u>	
H:M:S	Sec. from epoch	H:M:S	Sec. from epoch
11:32:58	1278	11:33:06	1286
11:40:21	1721	11:40:29	1729
11:42:31	1851	11:42:40	1860
11:46:40	2100	11:46:48	2108
11:48:22	2202	11:48:30	2210
11:50:20	2320	11:50:28	2328
11:51:32	2392	11:51:39	2399
11:52:48	2468	11:52:56	2476
11:53:38	2518	11:53:52	2532
11:54:19	2559	11:54:25	2565
11:55:39	2639	11:55:46	2646

Table IV. STS-19 (51-A) maneuver periods for extraction

μ_p , deg/sec

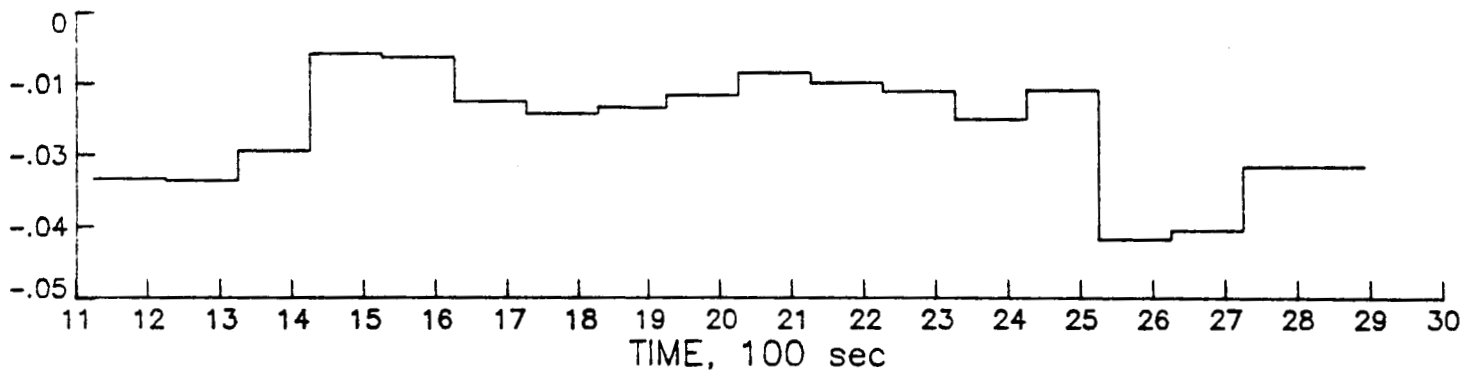
$$\sigma_\mu = .01201$$
$$\mu_{avg} = .02657$$



(a) Roll rate statistics versus time

μ_Q , deg/sec

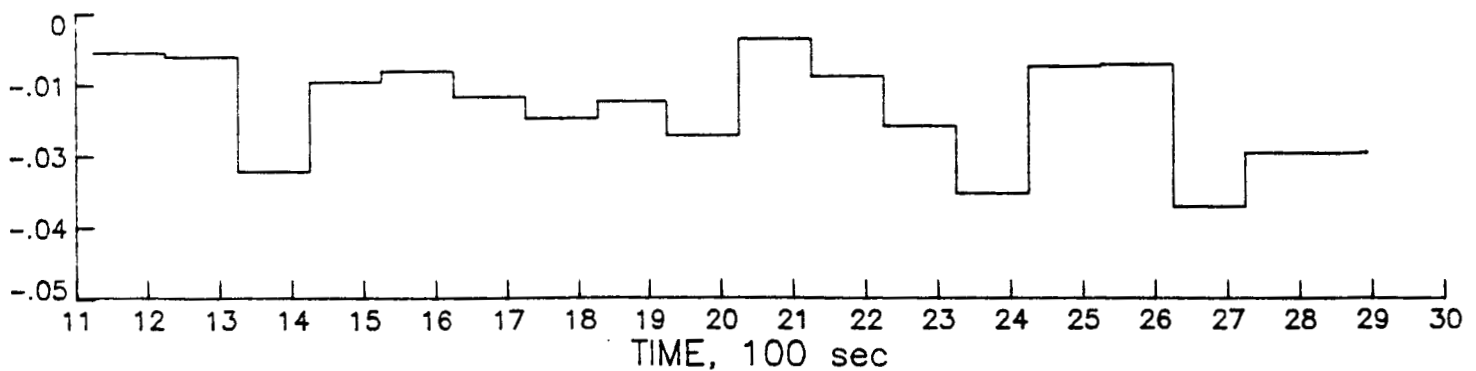
$$\sigma_\mu = .00971$$
$$\mu_{avg} = -.01992$$



(b) Pitch rate statistics versus time

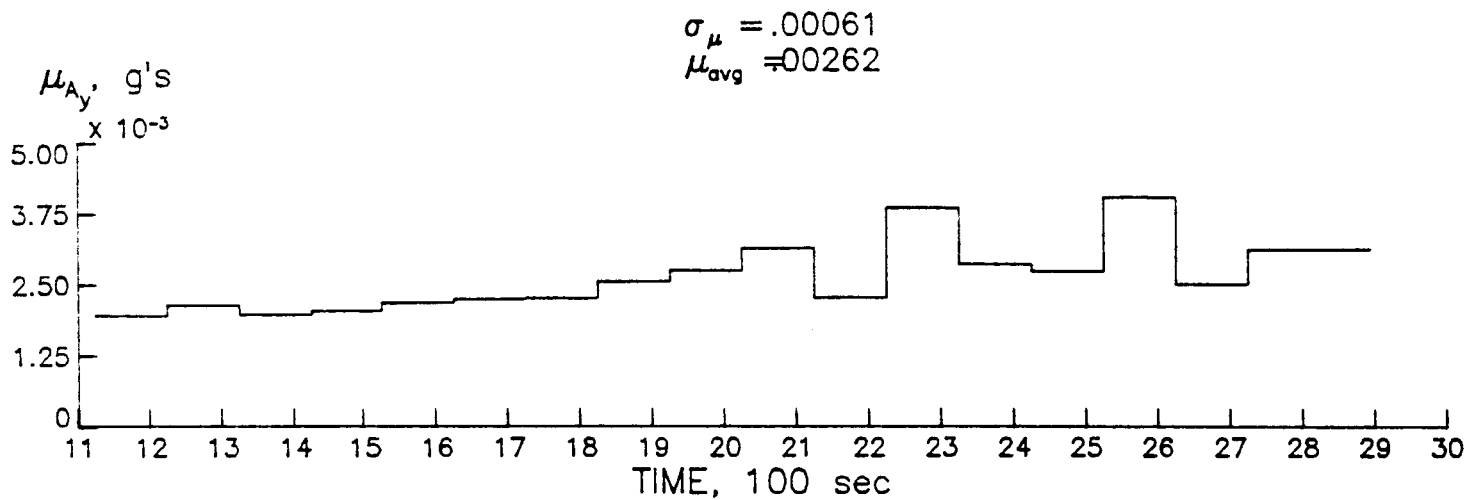
μ_R , deg/sec

$$\sigma_\mu = .00879$$
$$\mu_{avg} = -.01641$$

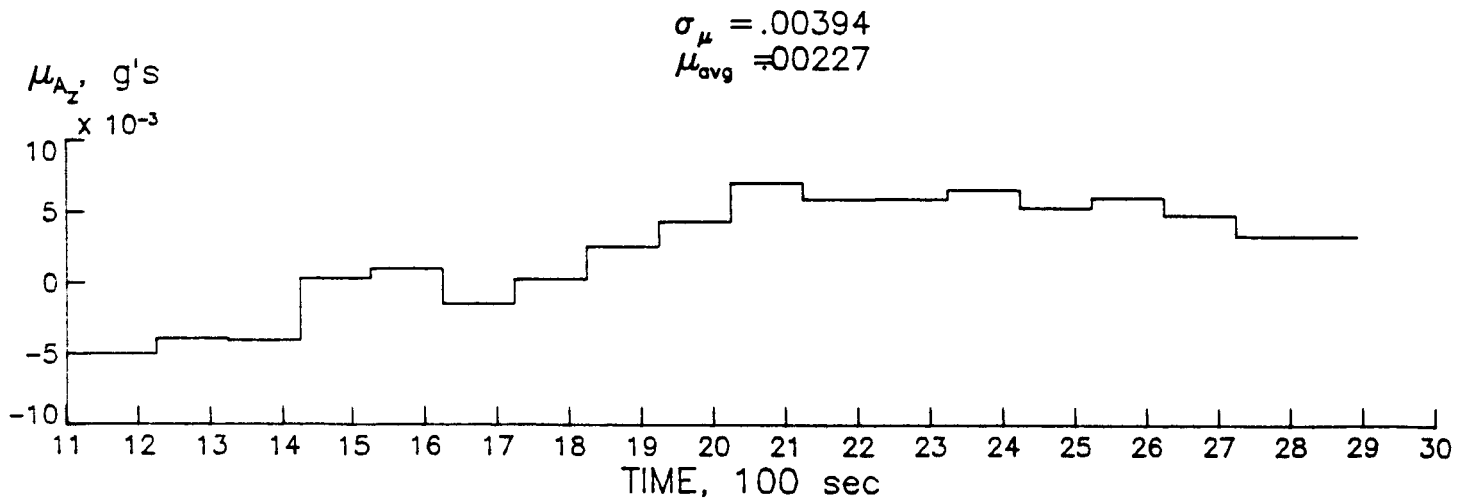


(c) Yaw rate statistics versus time

NOTE: NO AXIAL CHANNEL AVAILABLE
FROM AA PACKAGE



(e) Y-body acceleration statistics versus time



(f) Z-body acceleration statistics versus time

APPENDIX A
Spacecraft and Physical Constants

+++++IMU NBR 1 ATTITUDE INFORMATION+++++		
...INERTIAL (EE50) TO ROTATING (ETDD)		
-.72918866E+00	-.68430831E+00	.24564132E-02
.68430448E+00	-.72919280E+00	-.22909951E-02
.33589458E-02	.10365913E-04	.99999436E+00
...ROTATING (ETDD) TO N-E-D		
-.67170422E-01	.55671775E-01	.99618712E+00
-.63612852E+00	-.76992986E+00	0.
.76699421E+00	-.63569542E+00	.87242261E-01
...NAV BASE TO S/C BODY		
.98286611E+00	.11081625E-03	-.18432090E+00
-.35601724E-03	.99999910E+00	-.12972003E-02
.18432059E+00	.13405957E-02	.98236526E+00
...NAV BASE TO OUTER ROLL		
.99999683E+00	-.22274768E-02	-.11707061E-02
.22274753E-02	.99999752E+00	-.26077272E-05
.11707090E-02	0.	.99999932E+00
...PLATFORM TO OUTER ROLL		
-.58724730E+00	.79505544E+00	.15174578E+00
-.77921999E+00	-.50459849E+00	-.37174713E+00
-.21898890E+00	-.33655099E+00	.91584783E+00
...INERTIAL (EE50) TO PLATFORM		
.70390654E+00	-.28922021E+00	.64874285E+00
-.66903132E+00	.36792850E-01	.74232298E+00
-.23856390E+00	-.95655525E+00	-.16759866E+00
...S/C BODY TO N-E-D		
.19382149E+00	-.62196077E+00	-.53554939E+00
.26236709E+00	.56945254E+00	-.77886109E+00
.94516323E+00	.10181707E-01	.32643865E+00

Table A-1

STS-19 IMU attitude matrices @ epoch

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++++IMJ NR 2 ATTITUDE INFORMATION++++

...INERTIAL (EE50) TO ROTATING (ET00)		
- .72918866E+00	- .68430831E+00	.24564132E-02
.68430448E+00	- .72914280E+00	- .22909951E-02
.33589453E-02	.10365913E-04	.99999436E+00
...ROTATING (ET00) TO N-E-D		
- .67170422E-01	.55071775E-01	.99618712E+00
- .53812852E+00	- .76992986E+00	0.
.76699421E+00	- .63564542E+00	.67242261E-01
...NAV BASE TO S/C BODY		
.28286611E+00	.11061625E-03	- .16432090E+00
- .35001724E-03	.99999910E+00	- .12972003E-02
.18432059E+00	.13405957E-02	.98246526E+00
...NAV BASE TO OUTER ROLL		
.99999707E+00	- .14653600E-02	- .19236080E-02
.14654067E-02	.99999892E+00	.23933827E-04
.19236609E-02	- .26752760E-04	.99999810E+00
...PLATFORM TO OUTER ROLL		
.54140462E+00	- .33511901E+00	.77106751E+00
- .60156511E+00	- .48250320E+00	.35310472E+00
.25372046E+00	- .80924954E+00	- .52984901E+00
...INERTIAL (EE50) TO PLATFORM		
- .47205734E+00	- .63034874E+00	.61629730E+00
.50677354E+00	.37799728E+00	.77478617E+00
- .72134417E+00	.67805971E+00	.14101082E+00
...S/C BODY TO N-E-D		
.19301707E+00	- .82201170E+00	- .53576106E+00
.26279853E+00	.56938958E+00	- .77892958E+00
.94534694E+00	.95490357E-02	.32592547E+00

Table A-1

(continued)

+++++IMU NBR 3 ATTITUDE INFORMATION+++++

...INERTIAL (EE50) TO ROTATING (ET00)

-.72918366E+00	-.68430831E+00	.24564132E-02
.68430448E+00	-.72919280E+00	-.22909951E-02
.3358945E-02	.10366913E-04	.99999436E+00

...ROTATING (ET00) TO N-E-D

-.67170422E-01	.55671775E-01	.99618712E+00
-.63812852E+00	-.76992986E+00	0.
.76699471E+00	-.63569542E+00	.87242261E-01

...NAV BASE TO S/C BODY

.98286611E+00	.11081625E-03	-.18432090E+00
-.35601724E-03	.99999410E+00	-.12972003E-02
.1432059E+00	.13405957E-02	.98286526E+00

...NAV BASE TO OUTER ROLL

.99999950E+00	-.67501024E-03	.72914753E-03
.67503720E-03	.99999977E+00	-.36723830E-04
-.72912257E-03	.37215013E-04	.99999973E+00

...PLATFORM TO OUTER ROLL

.35383744E+00	-.15101996E+00	-.92303390E+00
-.34719936E+00	-.93757043E+00	.20302562E-01
-.86847638E+00	.31329309E+00	-.38418123E+00

...INERTIAL (EE50) TO PLATFORM

-.17977524E+00	.54070461E+00	.82177818E+00
.21471739E+00	-.79367661E+00	.56918699E+00
.95998318E+00	.27877587E+00	.26534700E-01

...S/C BODY TO N-E-D

.19259877E+00	-.82222678E+00	-.53557864E+00
.26351173E+00	.56908653E+00	-.77891014E+00
.94523384E+00	.83856750E-02	.32627195E+00

Table A-1

(concluded)

Planet Parameters

Physical Model

Polar Radius:	20,855,591.48 ft
Equatorial Radius:	20,925,741.47 ft
Rotational Rate:	.7292115147E-4 rad/sec

Gravity Model

Central mass, μ :	.1407646853E17 ft ³ /sec ²
J ₂ :	.10827E-2
C ₃₀ :	.256E-5
C ₄₀ :	.158E-5
C ₂₂ :	.157E-5
S ₂₂ :	-.897E-6

Runway 15 Location:

Altitude:	-199 ft (above ellipsoid)
Geodetic Latitude:	28.632927 deg
Longitude:	279.293967 deg
Azimuth:	149.988300 deg

Location of IMU relative to center-of-gravity in Body coordinates

(Assumed constant for entry reconstruction)

X _B	56 ft
Y _B	0.0 ft
Z _B	-4 ft

Spacecraft aerodynamic reference parameters

Reference Area	2690 ft ²
Span	78.057 ft
Chord	39.567 ft

Average Attitude Computations @ Epoch (40300 sec)

	<u>IMU1</u>	<u>IMU2</u>	<u>IMU3</u>	<u>μ</u>	<u>σ</u>
ψ (deg)	53.5973	53.7039	53.8372	53.7128	0.1202
θ (deg)	-70.9376	-70.9698	-70.9500	-70.9525	0.0163
ϕ (deg)	1.7865	1.6782	1.5600	1.6749	0.1133

TABLE A-2

Planet and Spacecraft Data Used for
BT19D19, ST19BET, and AEROBET Generation

Weight and Center-of-Gravity (c.g.) Location

<u>EVENT</u>	<u>TIME</u> (sec from epoch)	<u>WEIGHT</u> (lbs)	<u>X_{CG}</u> (inches in Orbiter Structural Reference)	<u>Y_{CG}</u>	<u>Z_{CG}</u>
EI	1038	209163.7	1083.4	-0.2	372.5
M3	2472	207982.7	1081.4	-0.2	371.8
Landing	2892	207505.7	1082.6	-0.1	369.1

Moments and Products of Inertia

<u>EVENT</u>	<u>I_{XX}</u>	<u>I_{YY}</u>	<u>I_{ZZ}</u>	<u>I_{XY}</u>	<u>I_{XZ}</u>	<u>I_{YZ}</u>
EI	892717.1	6813738.2	7106750.5	-518.2	160614.3	-1427.0
M3	886776.1	6773938.5	7068818.4	46.4	149294.8	-1303.3
Landing	915161.5	6787282.8	7057585.3	717.1	140210.9	-1176.8

NOTES

EI values assumed at epoch

Mach 3 values held constant until gear deploy (t=2877^s),
landed values adopted thereafter

TABLE A-3

STS-19 mass properties

APPENDIX B

Final residuals for STS-19 trajectory reconstruction

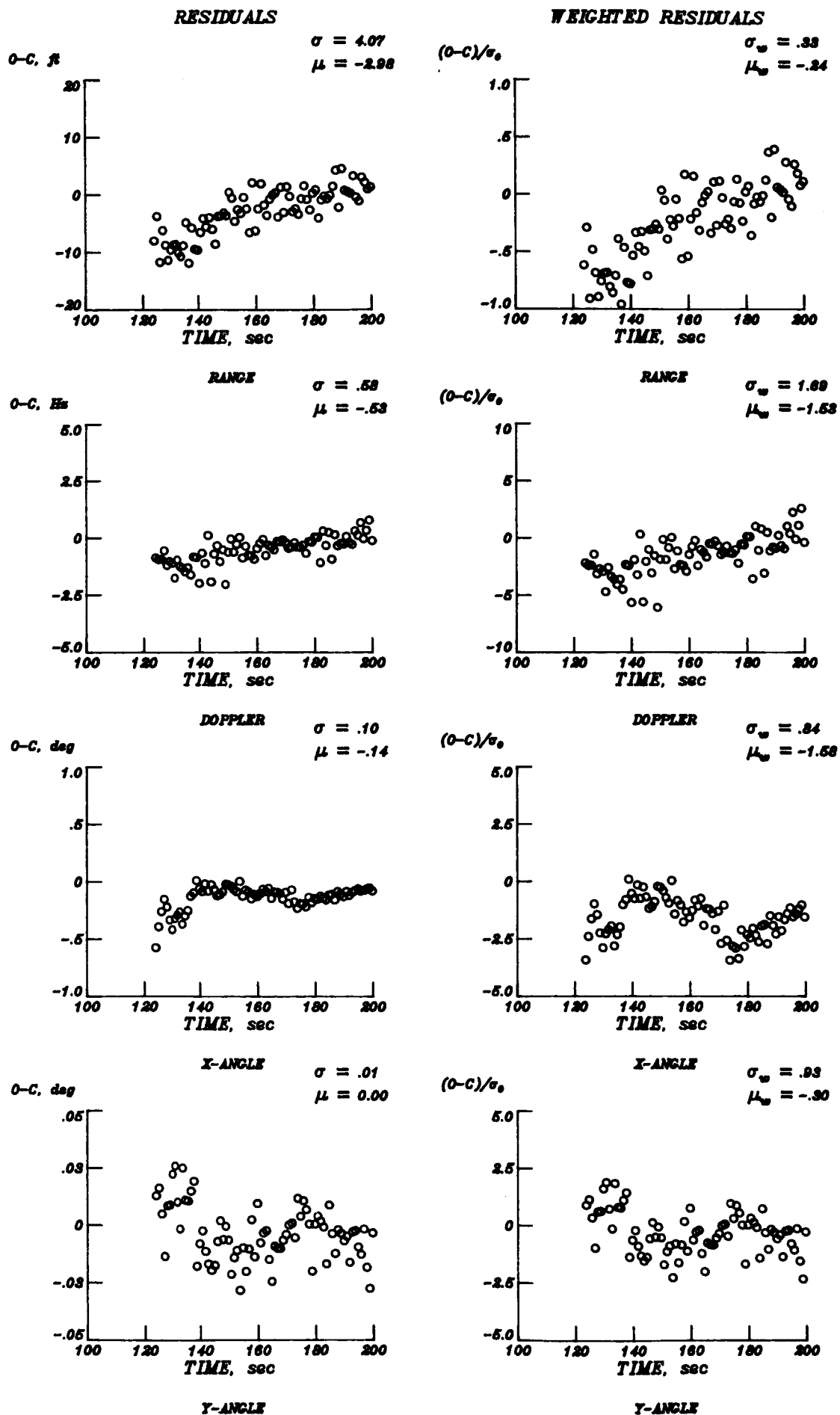


Fig. B-1. Smoothed residuals versus time for GWMS.

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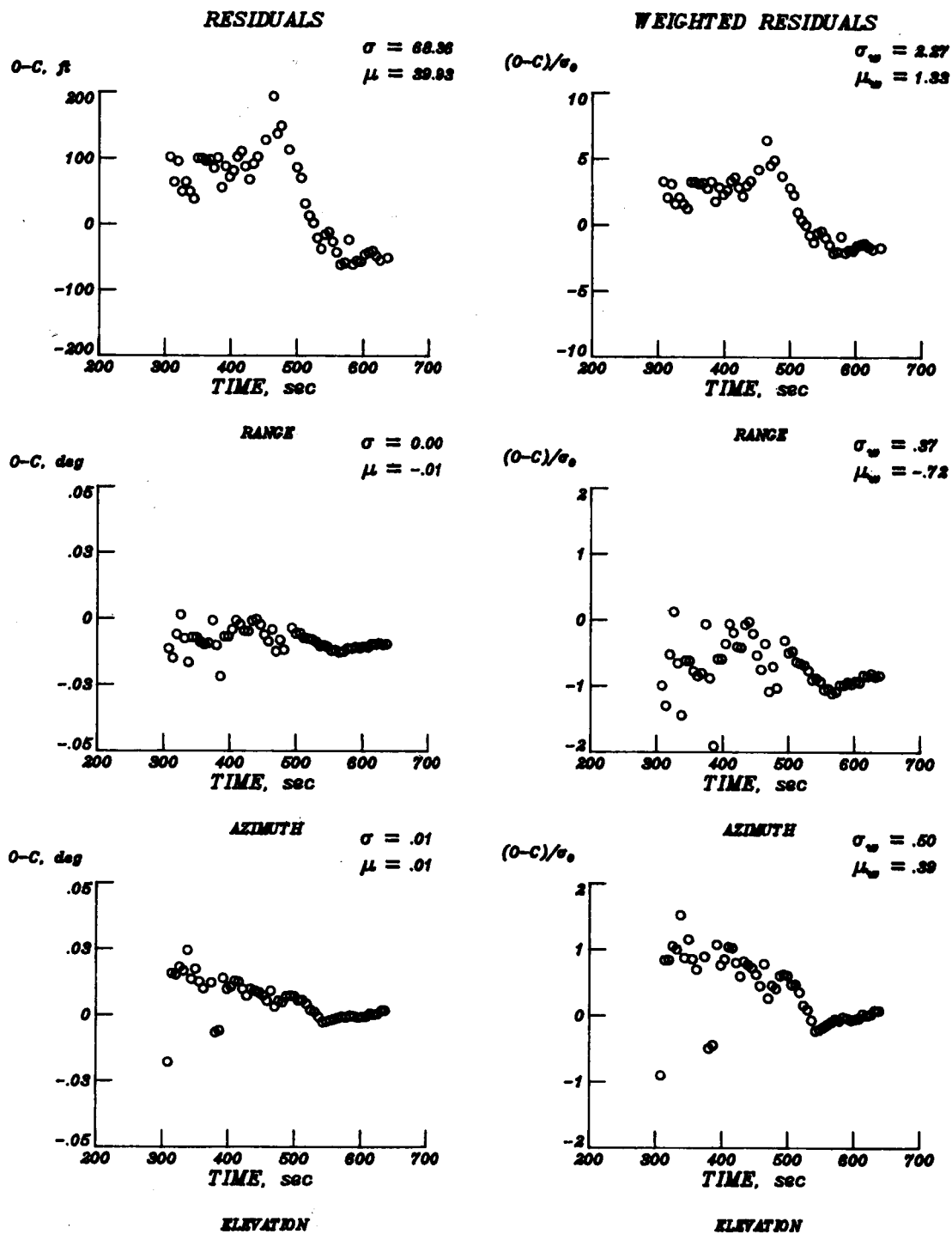


Fig. B-2. Smoothed residuals versus time for KMTc.

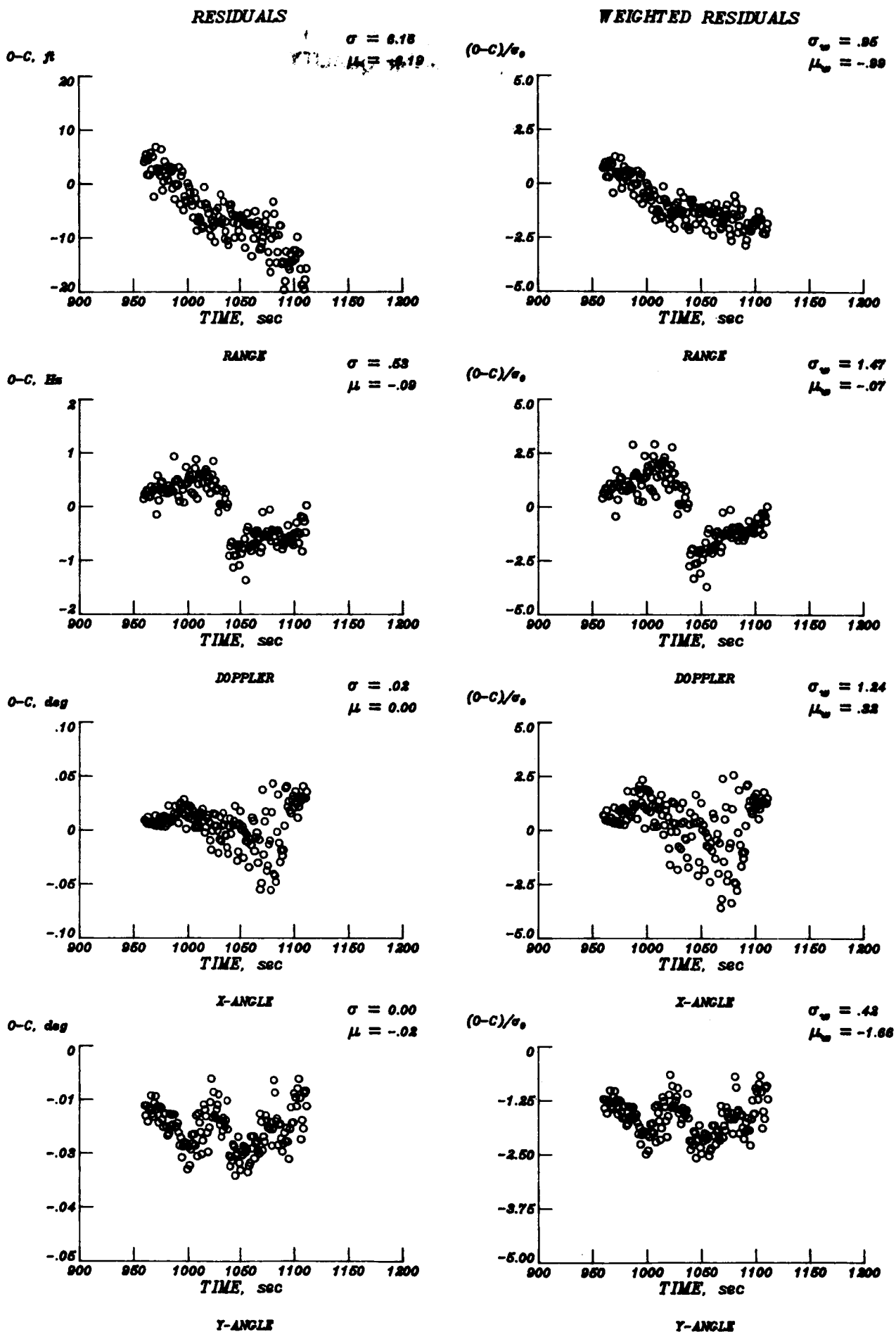


Fig. B-3. Smoothed residuals versus time for HAWS.

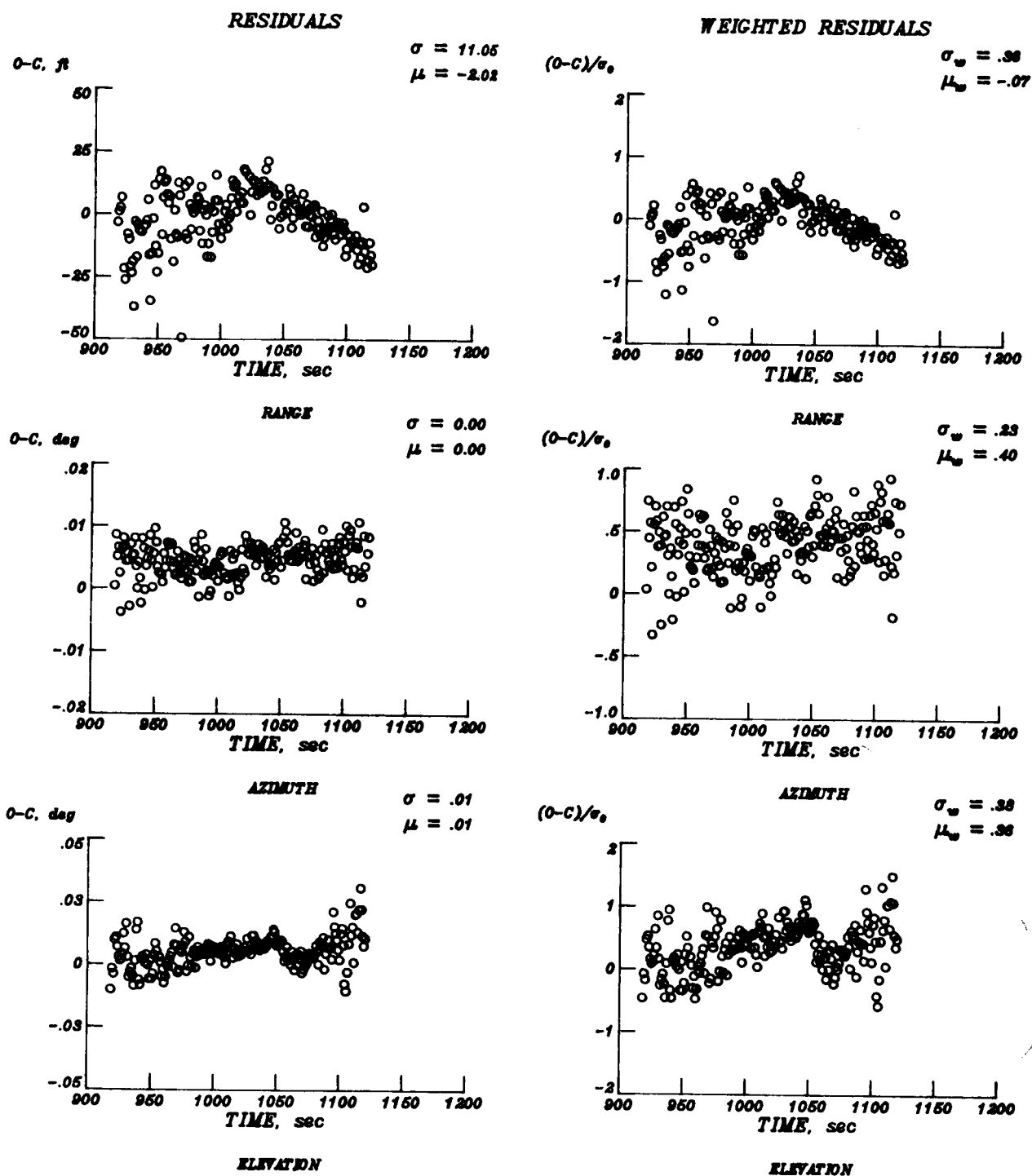


Fig. B-4. Smoothed residuals versus time for KPTC.

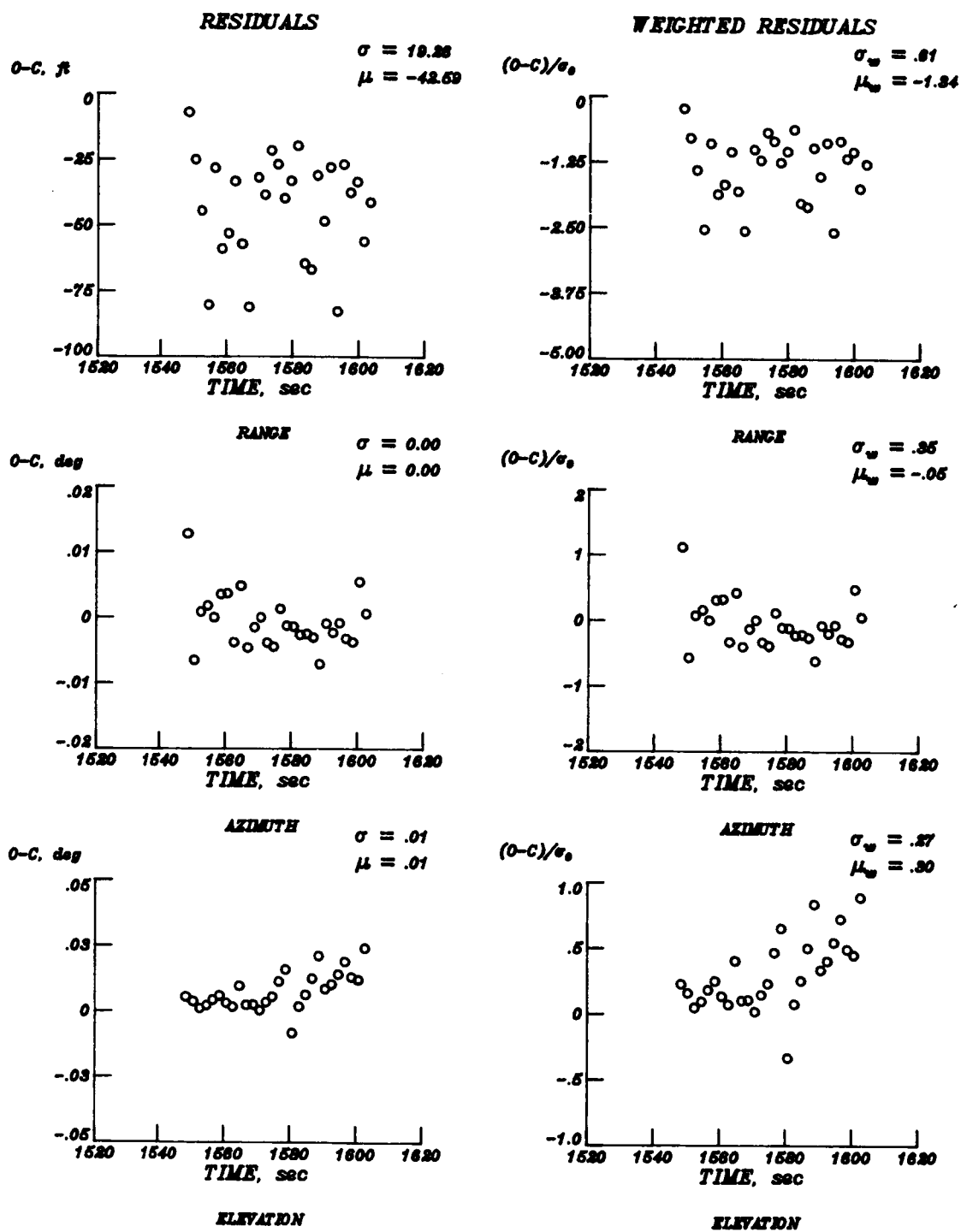


Fig. B-5. Smoothed residuals versus time for VDBC.

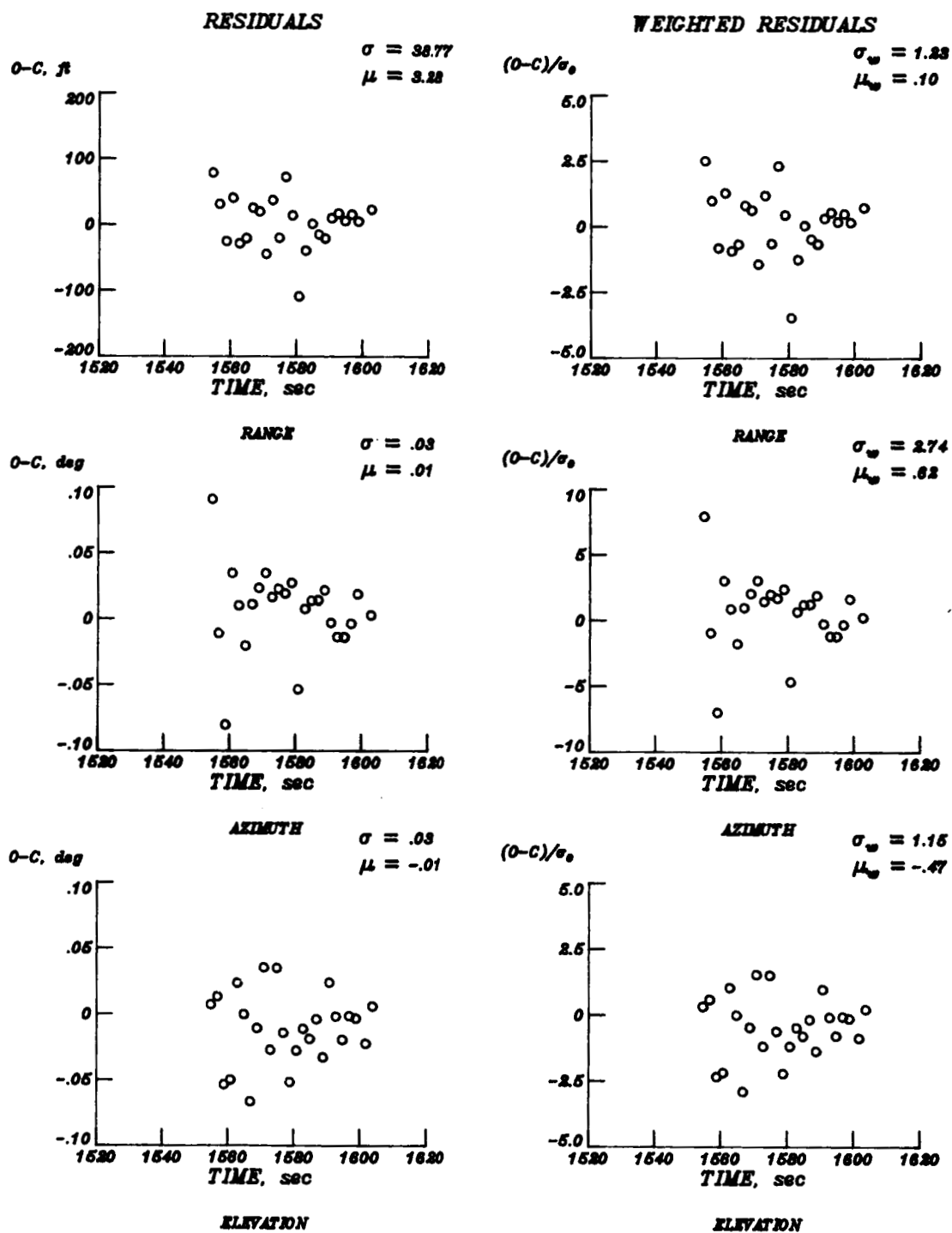


Fig. B-6. Smoothed residuals versus time for VDSC.

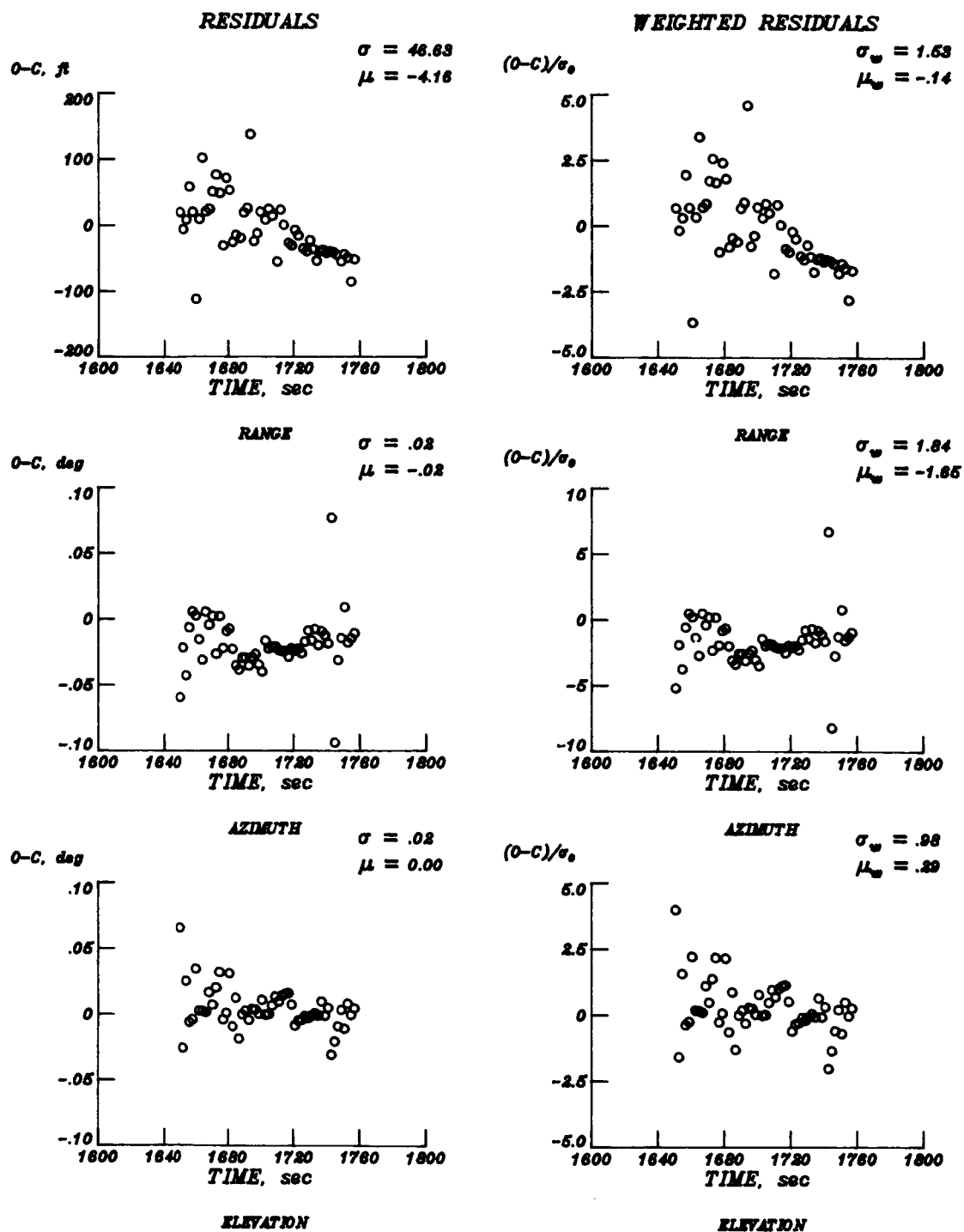


Fig. B-7. Smoothed residuals versus time for MTLIC.

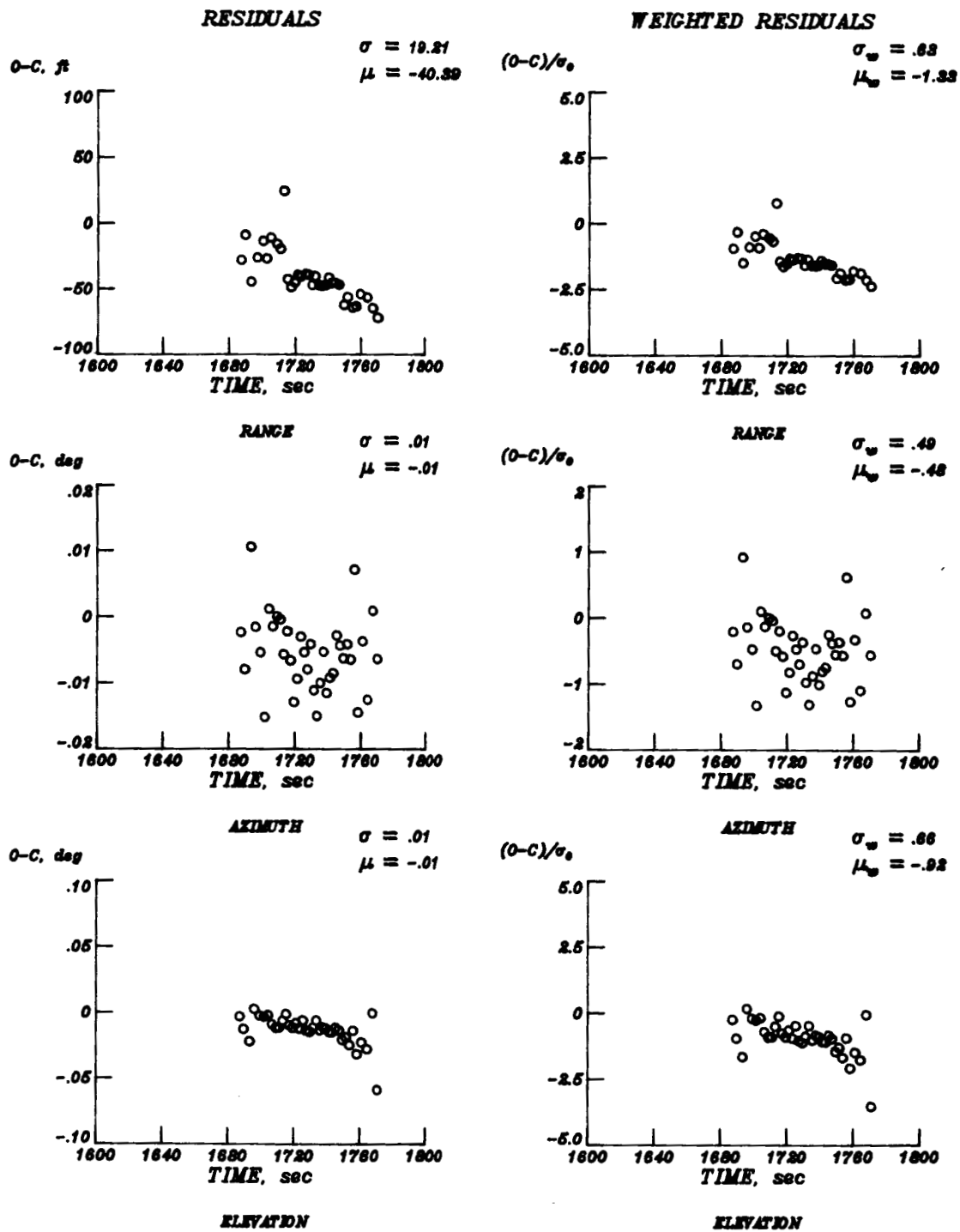


Fig. B-8. Smoothed residuals versus time for SPKC.

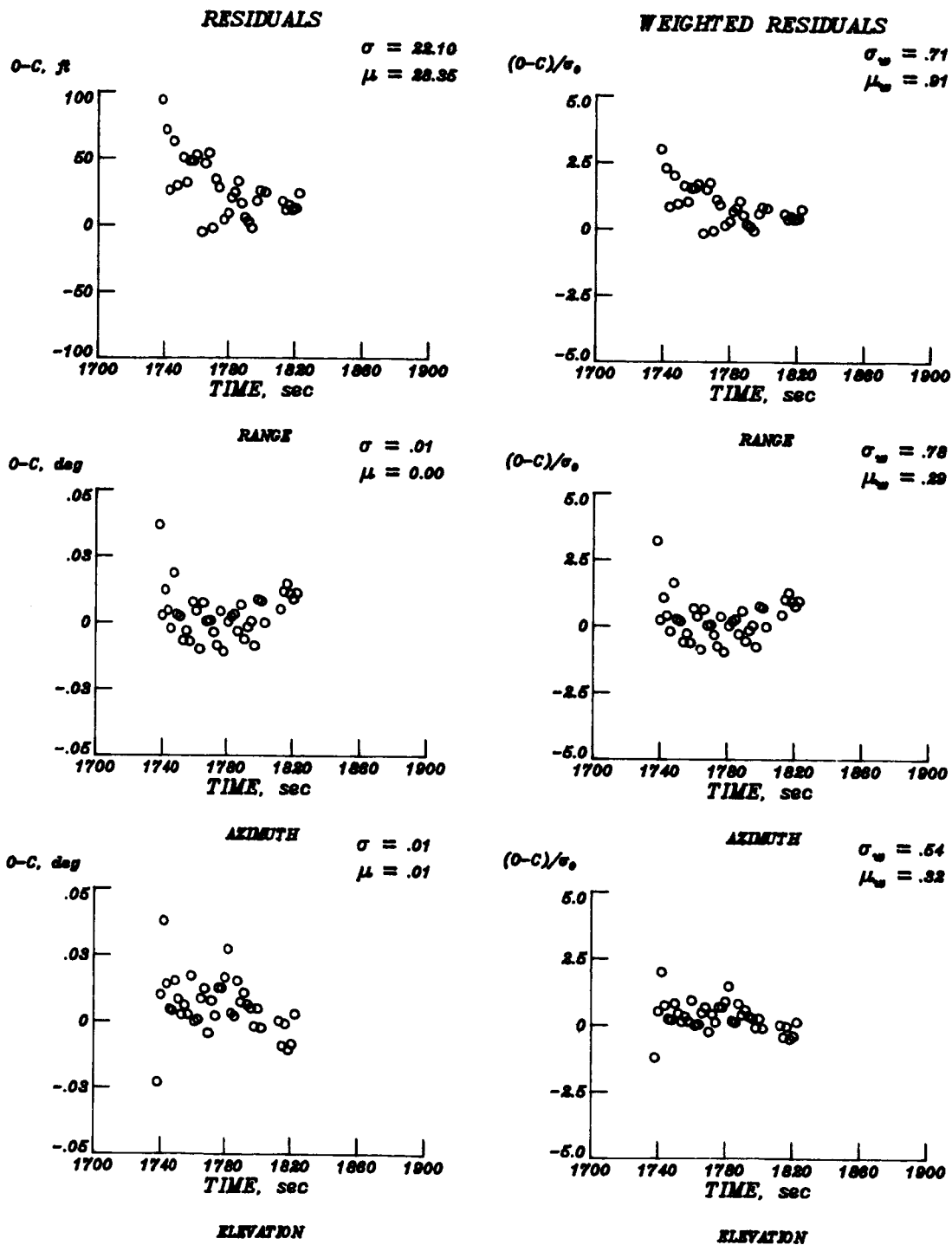


Fig. B-9. Smoothed residuals versus time for WSSC.

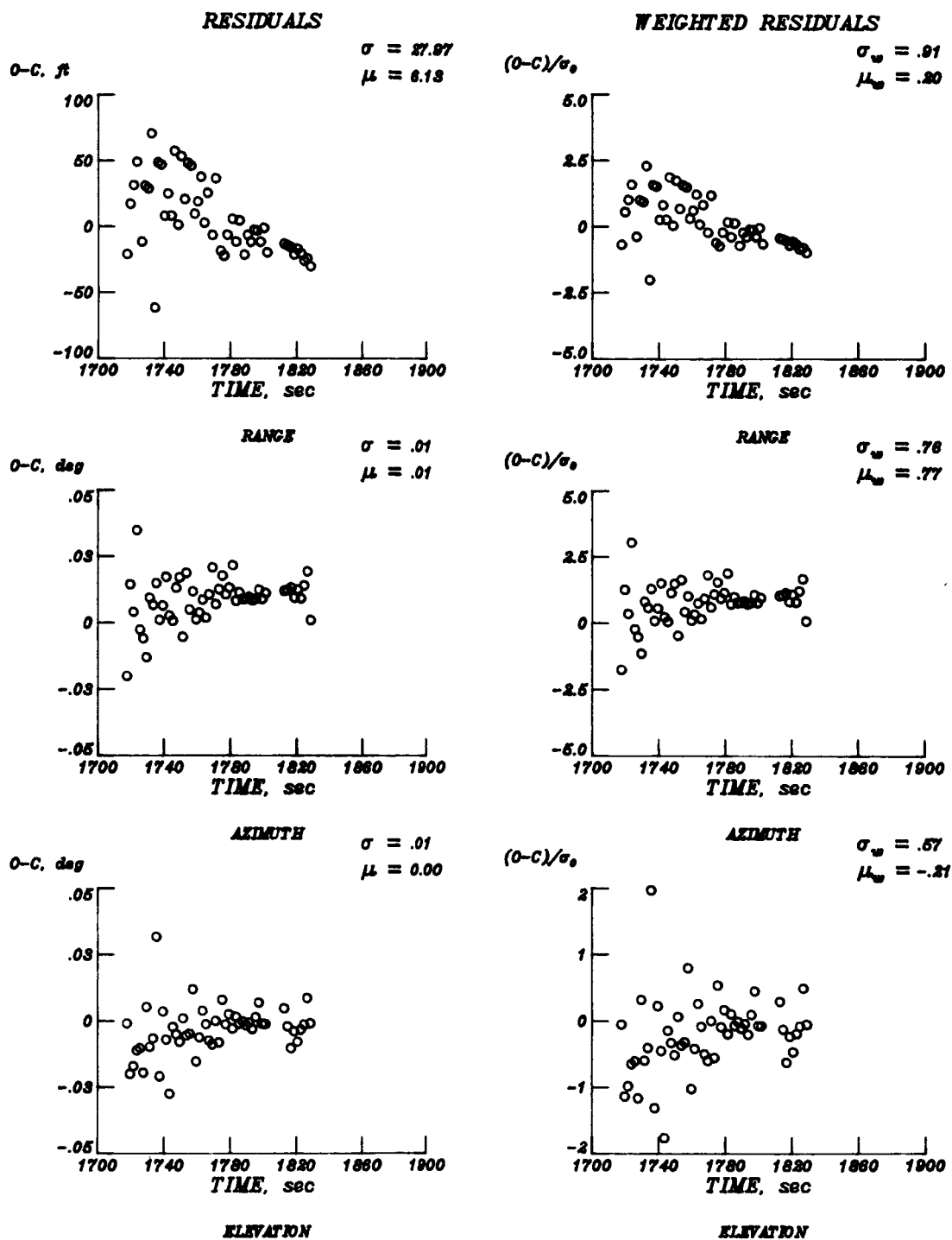


Fig. B-10. Smoothed residuals versus time for WHSC.

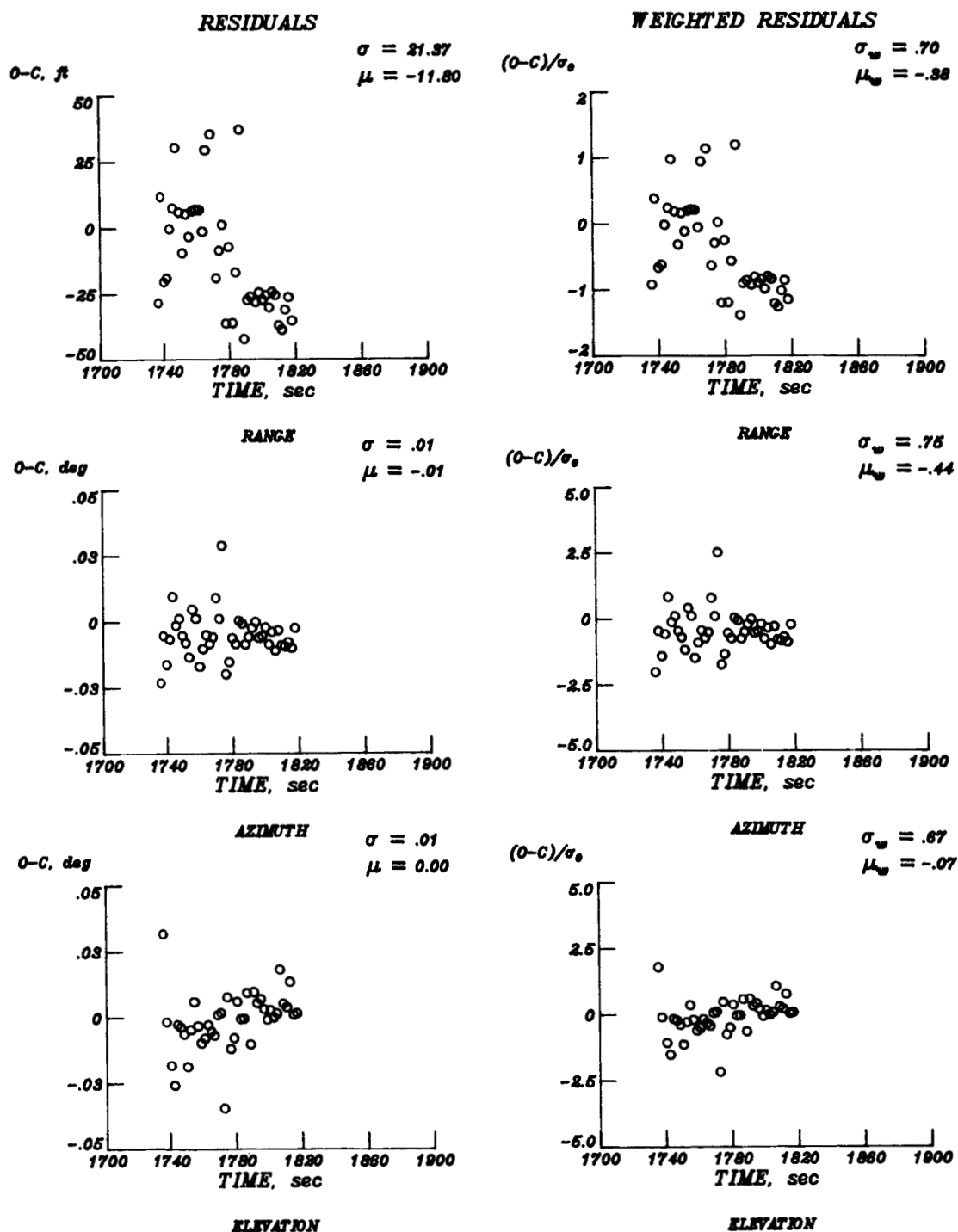
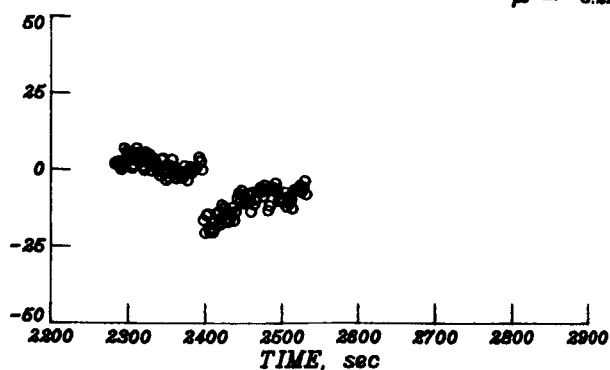


Fig. B-11. Smoothed residuals versus time for HOLC.

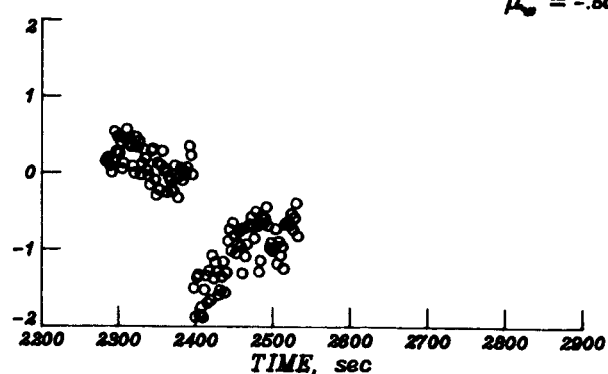
RESIDUALS

O-C, ft



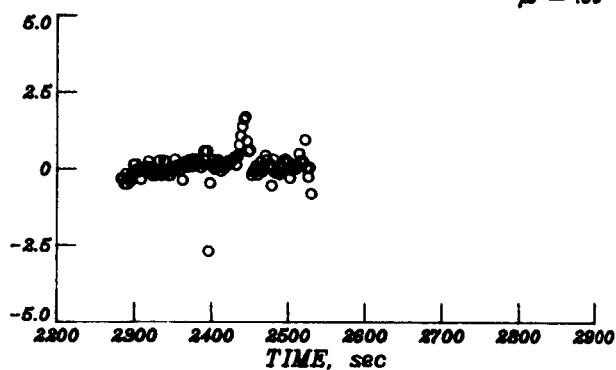
WEIGHTED RESIDUALS

(O-C)/ σ_0



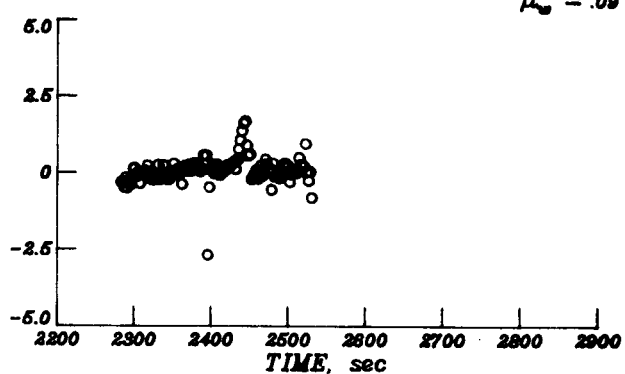
RANGE

O-C, Hz



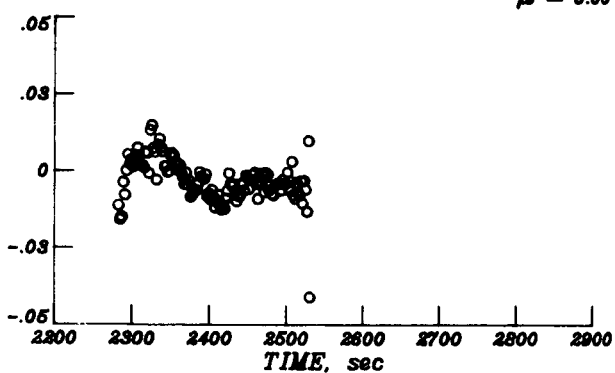
RANGE

(O-C)/ σ_0



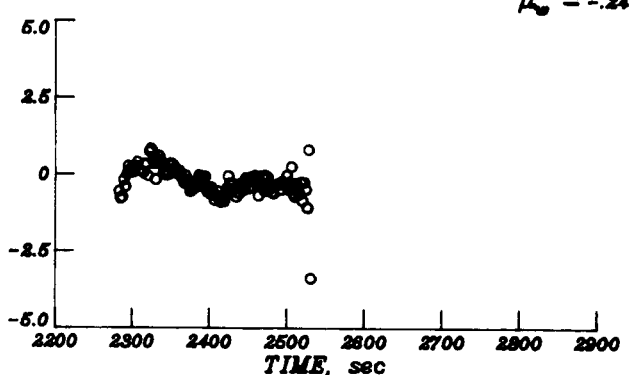
DOPPLER

O-C, deg



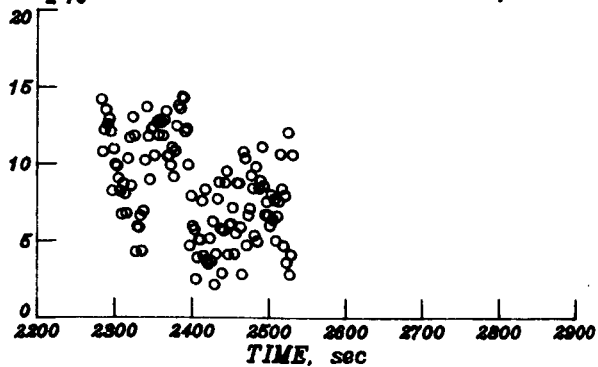
DOPPLER

(O-C)/ σ_0



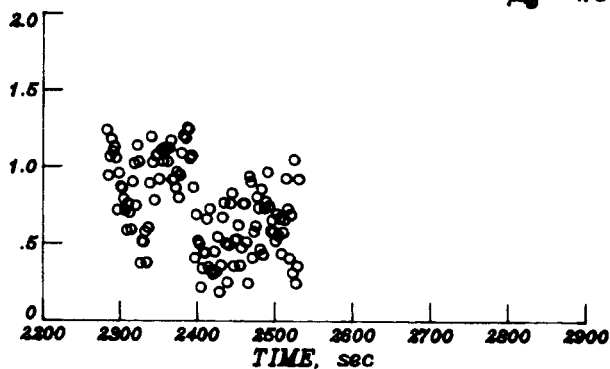
X-ANGLE

O-C, deg $\times 10^{-3}$



X-ANGLE

(O-C)/ σ_0



Y-ANGLE

Y-ANGLE

Fig. B-12. Smoothed residuals versus time for MILS.

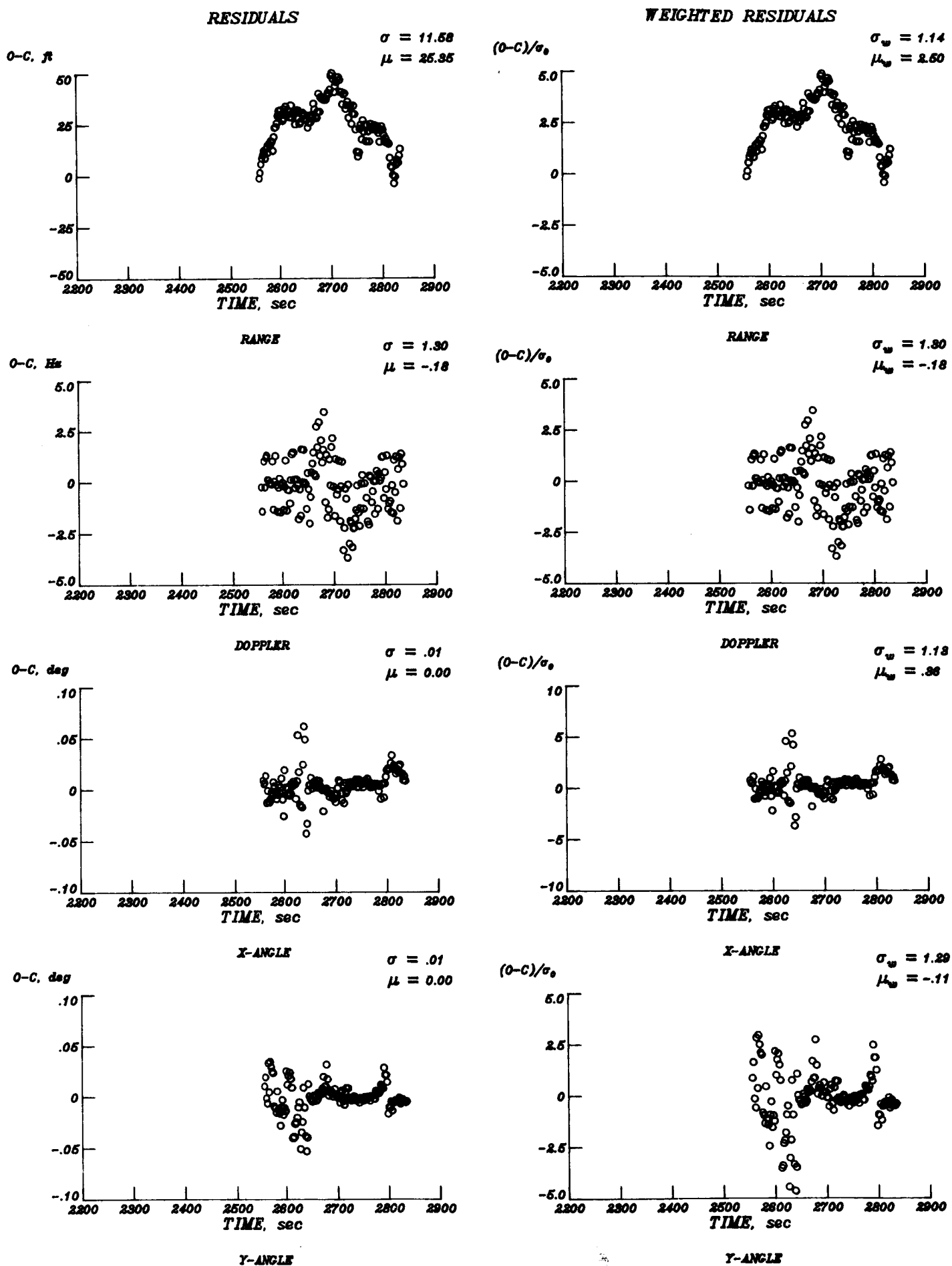
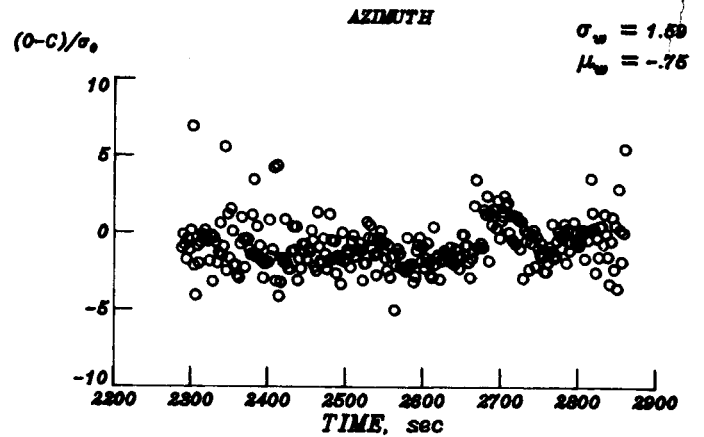
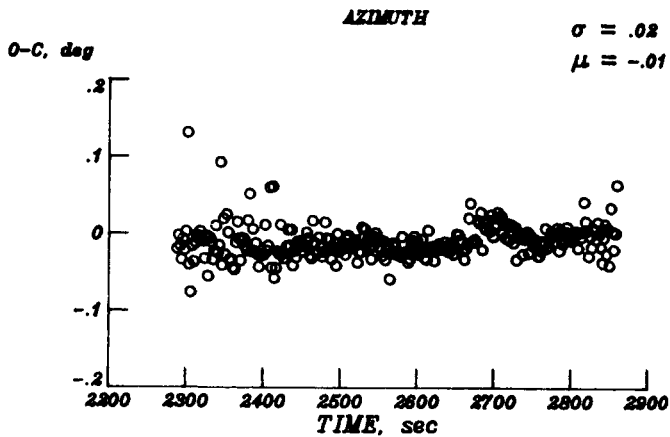
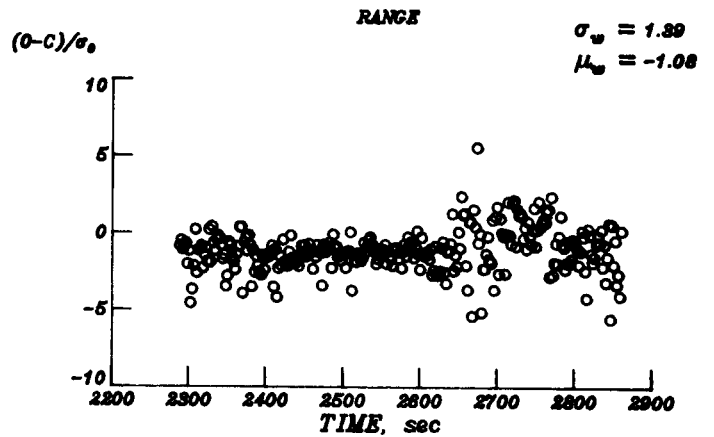
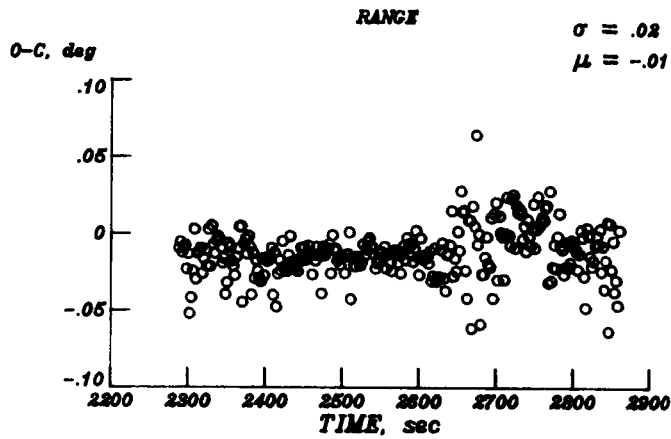
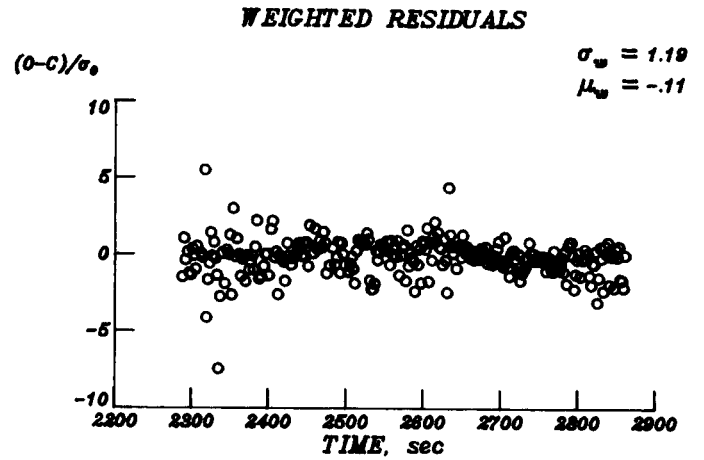
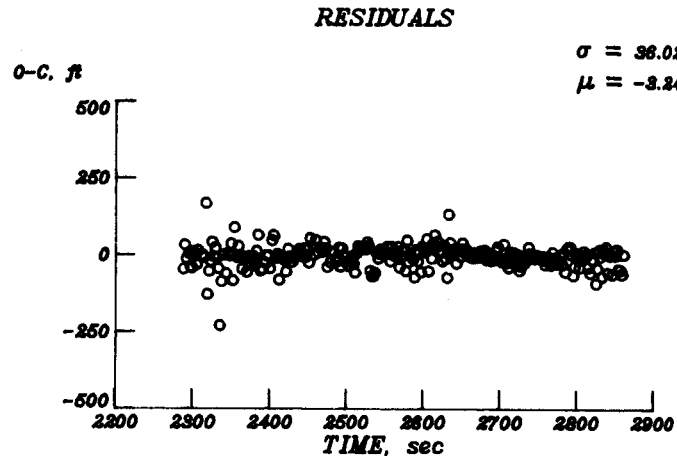


Fig. B-13. Smoothed residuals versus time for MLXS.



ELEVATION

ELEVATION

Fig. B-14. Smoothed residuals versus time for MLMC.

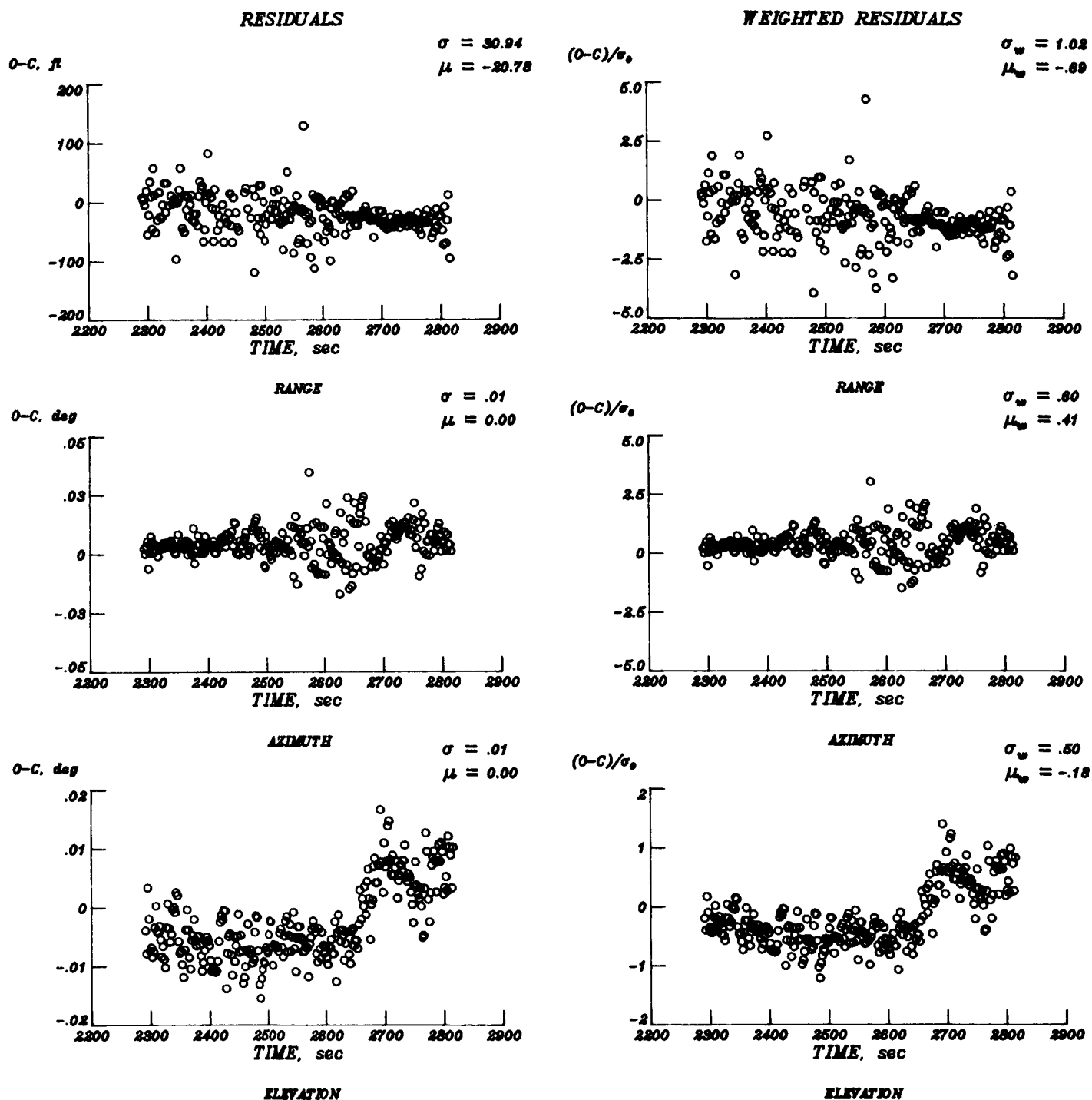


Fig. B-15. Smoothed residuals versus time for MLAC.

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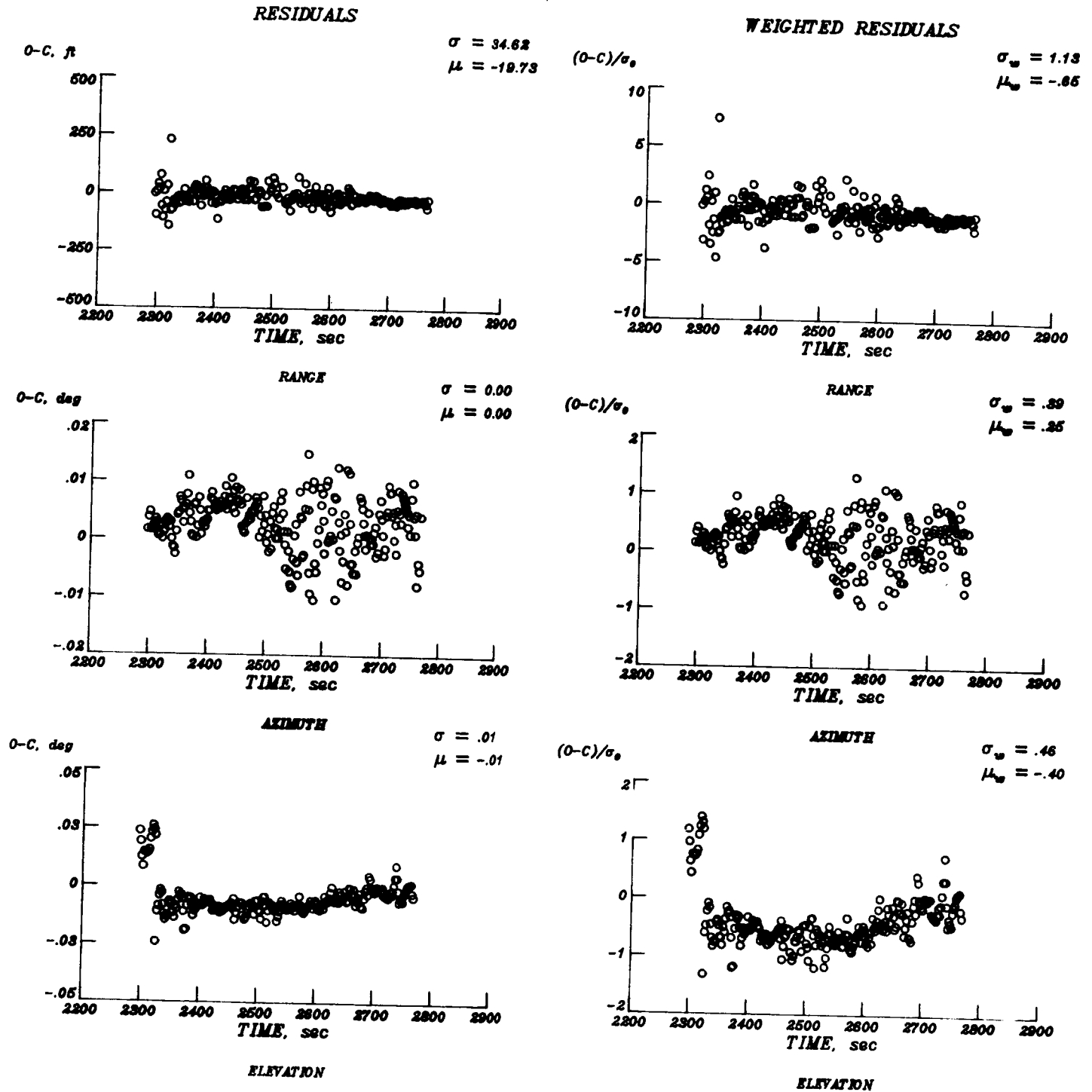


Fig. B-16. Smoothed residuals versus time for PATC.

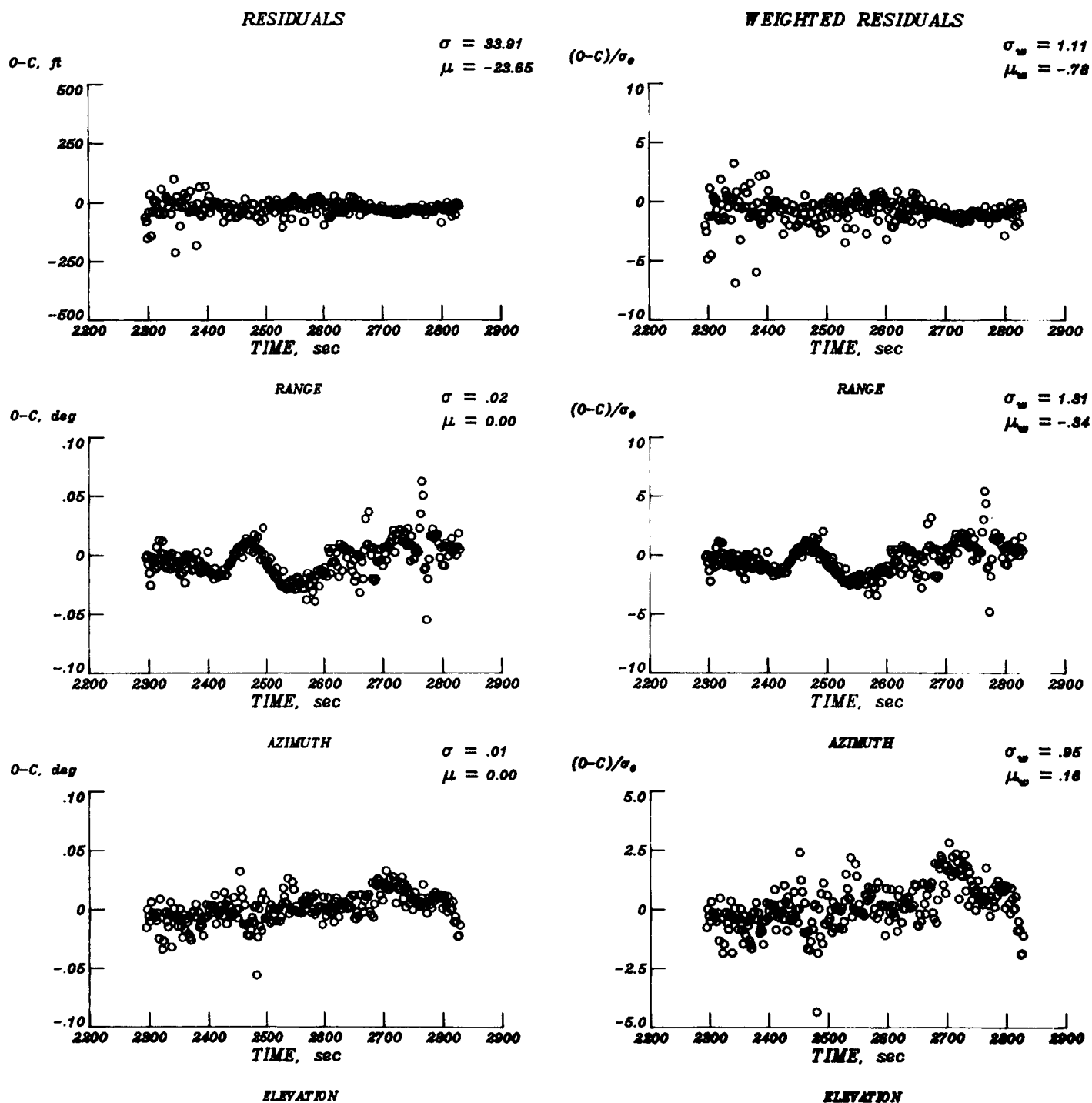


Fig. B-17. Smoothed residuals versus time for CNMC.

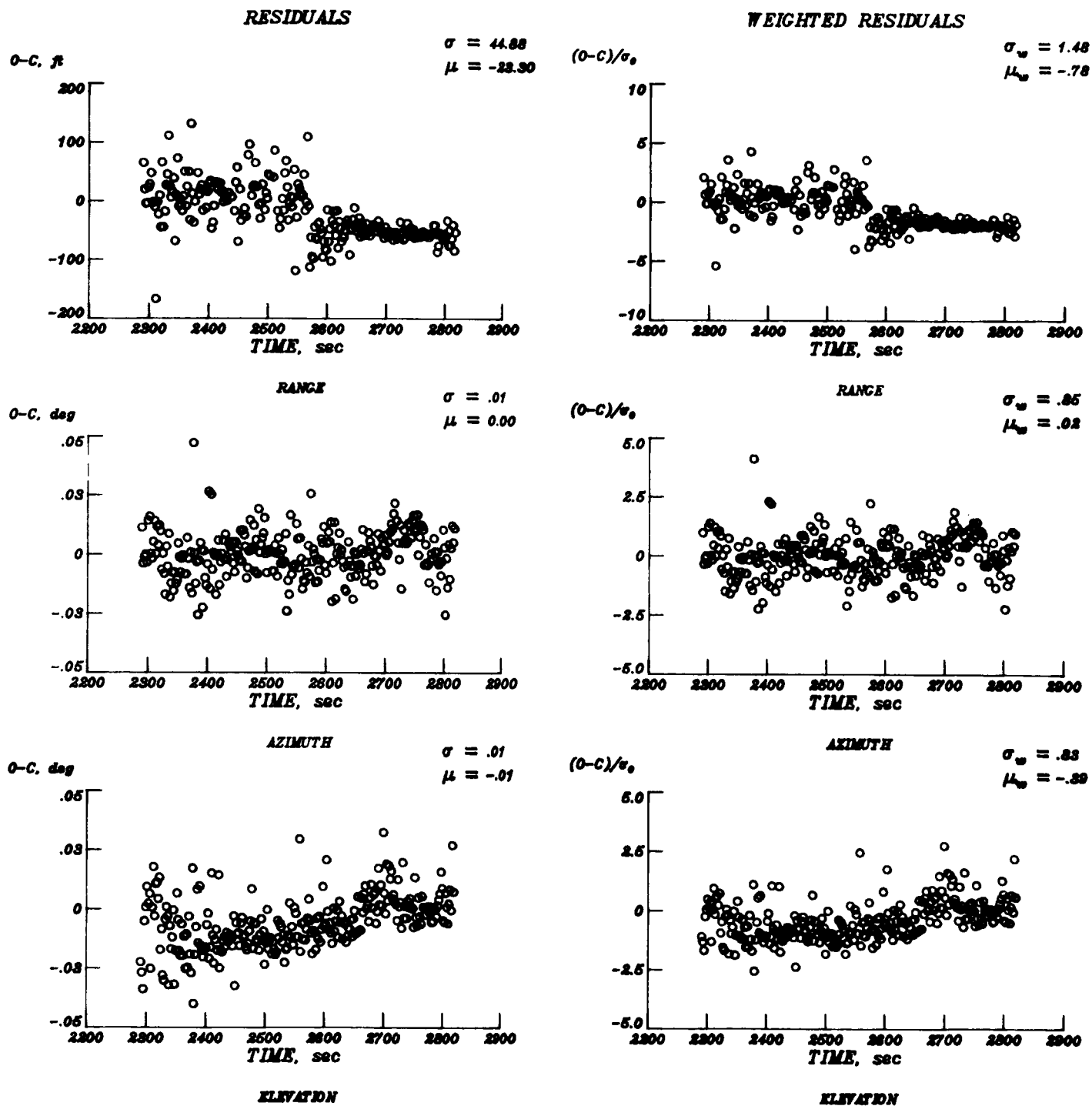


Fig. B-18. Smoothed residuals versus time for CNVC.

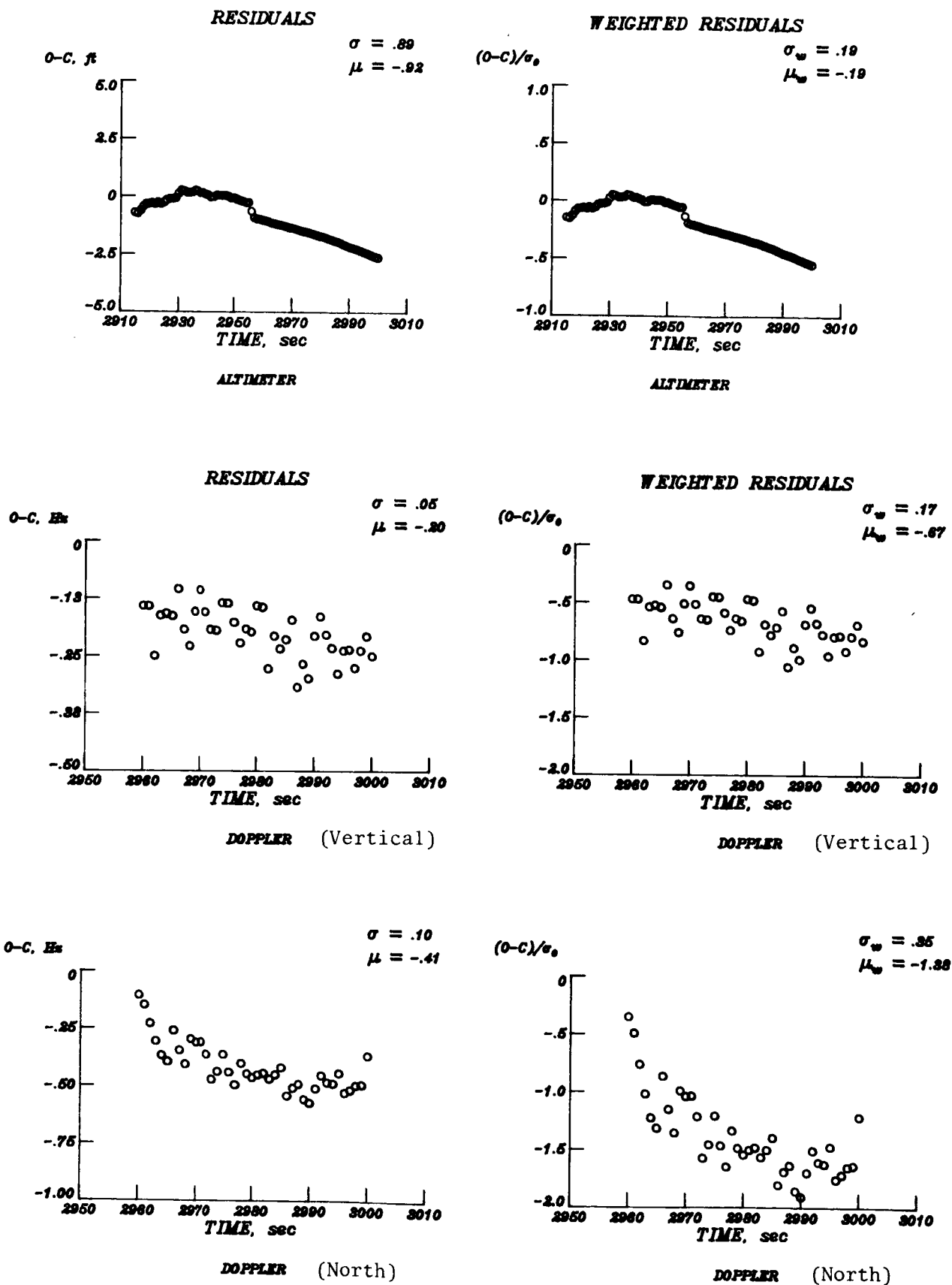


Fig. B-19. Smoothed residuals for altimeter and Doppler (pseudo data).

APPENDIX C

Listing of trajectory and air relative parameters
from final STS-19 (51-A) Extended BET
at two(2) second intervals

```

...DESCRIPTIVE DATA ( 48-WORDS )
ST19RET USING FLAIF19, INERTIAL-8T19D19, NP0264 DYN. DATA.
      R41116      3001 STS-19 INERTIAL BET /8T19D19/ (TREF=40300)
INITIAL CONDITIONS FROM ARHQHZ (ESOLVE) 12-18-84
IMU NBR 2 EA SEQ 1 (TAPE NTO662)
S,C-BAND, PSEUDO ALTIMETER (POST WONG), PSEUDO DOPPLER (POST STOP)
SOLUTION SET--STATE, ACCELEROMETER SCALE FACTORS

```

.....LABELS AND UNITS FOR DATA ITEMS

(	1)	TIME	SEC	(	2)	VEL A	FT/SEC	(	3)	GAM A	DEG
(	4)	Hdg A	DEG	(	5)	ALTDE	FEET	(	6)	LATD	DEG
(	7)	LONG	DEG	(	8)	SIGMAA	DEG	(	9)	BETA A	DEG
(	10)	ALPHA A	DEG	(	11)	YAW E	DEG	(	12)	PTCH E	DEG
(	13)	ROLL E	DEG	(	14)	U	FT/SEC	(	15)	V	FT/SEC
(	16)	W	FT/SEC	(	17)	VEL R	FT/SEC	(	18)	GAM R	DEG
(	19)	Hdg R	DEG	(	20)	SIGMAR	DEG	(	21)	BETA R	DEG
(	22)	ALPHAR	DEG	(	23)	U-WIND	FT/SEC	(	24)	V-WIND	FT/SEC
(	25)	W-WIND	FT/SEC	(	26)	SIG-VA	FT/SEC	(	27)	SIG-GA	DEG
(	28)	SIG-HA	DEG	(	29)	SIG-H	FEET	(	30)	SIG-LA	DEG
(	31)	SIG-LO	DEG	(	32)	SIG-SA	DEG	(	33)	SIG-BA	DEG
(	34)	SIG-AA	DEG	(	35)	SIG-YE	DEG	(	36)	SIG-PE	DEG
(	37)	SIG-RE	DEG	(	38)	SIG-U	FT/SEC	(	39)	SIG-V	FT/SEC
(	40)	SIG-M	FT/SEC	(	41)	MACH A	NONE	(	42)	MACH R	NONE
(	43)	PINF	PSF	(	44)	TEMP	DEG RANKIN	(	45)	RHD	SLUGS/FT ³
(	46)	Q A	PSF	(	47)	Q R	PSF	(	48)	PSTAG	PSF
(	49)	P	VEG/SEC	(	50)	Q	DEG/SEC	(	51)	R	DEG/SEC
(	52)	X ACCEL	FT/SEC/SEC	(	53)	Y ACCEL	FT/S C/SEC	(	54)	Z ACCEL	FT/SEC/SEC
(	55)	CXB	NONE	(	56)	CYB	NONE	(	57)	CZB	NONE
(	58)	CL	NONE	(	59)	CO	NONE	(	60)	L/D	NONE
(	61)	CL-ROLL	NONE	(	62)	CM-PITCH	NONE	(	63)	CN-YAW	NONE
(64)	POOT	DEG/SEC ²	(65)	QDOT	DEG/SEC ²	(66)	RDOT	DEG/SEC ²

```

...NUMERICAL DATA
ISERN0 1 NWDS 66 IUNITS
EPOCH .40300000E+05 RADE

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20925741F+08 RADP .20855591E+08 OMEGA .72921151E-04

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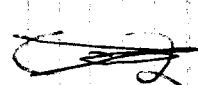
TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
0.0	1044473.3	23705.0	-1.188	60.107	.423	4.814	-69.822	11.537	.000
2.0	1043476.4	23706.2	-1.190	60.096	.384	4.822	-69.801	11.540	.000
4.0	1042477.6	23707.4	-1.193	60.086	.348	4.827	-69.853	11.542	.000
6.0	1041476.8	23708.6	-1.195	60.075	.316	4.830	-69.982	11.544	.000
8.0	1040474.0	23709.8	-1.198	60.065	.287	4.831	-70.185	11.547	.000
10.0	1039469.4	23711.0	-1.200	60.055	.254	4.863	-70.454	11.549	.000
12.0	1038462.6	23712.2	-1.203	60.045	.229	4.868	-70.799	11.552	.000
14.0	1037454.3	23713.4	-1.205	60.035	.210	4.867	-71.222	11.554	.000
16.0	1036443.8	23714.7	-1.207	60.025	.190	4.877	-71.706	11.556	.000
18.0	1035431.5	23715.9	-1.210	60.016	.177	4.871	-72.275	11.559	.000
20.0	1034417.3	23717.1	-1.212	60.006	.163	4.877	-72.924	11.561	.000
22.0	1033401.2	23718.3	-1.215	59.997	.149	4.888	-73.639	11.564	.000
24.0	1032383.1	23719.6	-1.217	59.988	.142	4.879	-74.432	11.566	.000
26.0	1031363.2	23720.6	-1.220	59.979	.137	4.887	-74.754	11.569	.000
28.0	1030341.2	23721.8	-1.222	59.970	.133	4.887	-74.743	11.571	.000
30.0	1029317.5	23723.0	-1.225	59.961	.130	4.888	-74.725	11.573	.000
32.0	1028291.6	23724.3	-1.227	59.952	.131	4.874	-74.679	11.576	.000
34.0	1027264.2	23725.5	-1.229	59.944	.139	4.877	-74.637	11.578	.000
36.0	1026234.8	23726.6	-1.232	59.936	.145	4.867	-74.494	11.581	.000
38.0	1025203.4	23727.9	-1.234	59.927	.153	4.870	-74.235	11.583	.000
40.0	1024170.2	23729.1	-1.236	59.919	.170	4.863	-74.047	11.586	.000
42.0	1023135.2	23730.4	-1.239	59.911	.188	4.852	-73.929	11.588	.000
44.0	1022098.3	23731.7	-1.241	59.903	.211	4.838	-73.896	11.591	.000
46.0	1021054.6	23732.9	-1.244	59.896	.227	4.828	-73.900	11.593	.000
48.0	1020019.0	23734.1	-1.246	59.888	.249	4.822	-73.582	11.596	.000
50.0	1018976.0	23735.3	-1.248	59.861	.276	4.825	-73.337	11.598	.000
52.0	1017932.3	23736.6	-1.251	59.874	.301	4.810	-73.153	11.601	.000
54.0	1016896.3	23737.8	-1.253	59.866	.333	4.803	-73.052	11.603	.000
56.0	1015838.4	23739.1	-1.255	59.859	.368	4.797	-73.027	11.606	.000
58.0	1014788.6	23740.4	-1.258	59.853	.400	4.781	-73.060	11.608	.000

 * ST19BET USING FLAIR19, INERTIAL-BT19D19, NP0264 DYN. DATA. *
 * PAGE 2 *

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
60.0	1013737.1	23741.7	-1.260	59.846	.444	4.779	-72.866	11.611	.000
62.0	1012683.6	23743.0	-1.262	59.839	.476	4.780	-72.522	11.614	.000
64.0	1011628.4	23744.3	-1.265	59.833	.513	4.780	-72.189	11.616	.000
66.0	1010571.3	23745.6	-1.267	59.826	.515	4.791	-71.835	11.619	.000
68.0	1009512.4	23746.9	-1.269	59.820	.450	4.802	-71.480	11.621	.000
70.0	1008451.6	23748.2	-1.272	59.814	.380	4.829	-71.125	11.624	.000
72.0	1007388.4	23749.5	-1.274	59.808	.318	4.856	-70.765	11.626	.000
74.0	1006324.5	23750.8	-1.276	59.802	.246	4.888	-70.396	11.629	.000
76.0	1005258.3	23752.1	-1.279	59.797	.175	4.917	-70.026	11.632	.000
78.0	1004190.3	23753.4	-1.281	59.791	.116	4.945	-69.656	11.634	.000
80.0	1003120.5	23754.7	-1.283	59.786	.050	4.982	-69.268	11.637	.000
82.0	1002048.9	23756.1	-1.286	59.781	-.023	5.021	-68.891	11.640	.000
84.0	1000975.4	23757.4	-1.288	59.776	-.091	5.058	-68.510	11.642	.000
86.0	999900.2	23758.7	-1.290	59.771	-.154	5.099	-68.123	11.645	.000
88.0	998823.3	23760.0	-1.292	59.766	-.218	5.137	-67.738	11.648	.000
90.0	997744.5	23761.3	-1.295	59.761	-.290	5.180	-67.344	11.650	.000
92.0	996664.0	23762.7	-1.297	59.756	-.350	5.224	-66.949	11.653	.000
94.0	995531.7	23764.0	-1.299	59.752	-.417	5.272	-66.549	11.656	.000
96.0	994497.7	23765.4	-1.301	59.748	-.488	5.323	-66.145	11.658	.000
98.0	993411.9	23766.7	-1.304	59.744	-.562	5.373	-65.748	11.661	.000
100.0	992324.4	23768.0	-1.306	59.740	-.633	5.435	-65.347	11.664	.000
102.0	991235.1	23769.3	-1.308	59.736	-.703	5.499	-64.932	11.666	.000
104.0	990144.1	23770.7	-1.310	59.732	-.776	5.570	-64.523	11.669	.000
106.0	989051.4	23772.0	-1.313	59.728	-.797	5.537	-64.097	11.672	.000
108.0	987956.9	23773.4	-1.315	59.725	-.793	5.473	-63.671	11.674	.000
110.0	986860.7	23774.7	-1.317	59.722	-.795	5.409	-63.242	11.677	.000
112.0	985762.8	23776.1	-1.319	59.718	-.791	5.350	-62.806	11.680	.000
114.0	984663.2	23777.4	-1.321	59.715	-.787	5.300	-62.367	11.683	.000
116.0	983561.9	23778.8	-1.323	59.712	-.777	5.241	-61.932	11.685	.000
118.0	982458.9	23780.2	-1.326	59.710	-.776	5.190	-61.489	11.688	.000

 * ST198ET USING FLAIR19, INERTIAL-BT19D19, NPO264 DYN. DATA. *
 * PAGE 3 *

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAHA (DEG)	MACHA (-)	QA (PSF)
120.0	981354.2	23781.5	-1.328	59.707	-0.766	5.134	-61.168	11.691	.000
122.0	980247.9	23782.9	-1.330	59.705	-0.754	5.084	-60.974	11.694	.000
124.0	979139.8	23784.2	-1.332	59.702	-0.748	5.048	-60.867	11.697	.000
126.0	978030.1	23735.6	-1.334	59.700	-0.731	4.999	-60.792	11.699	.000
128.0	976918.7	23787.0	-1.336	59.698	-0.724	4.961	-60.720	11.702	.000
130.0	975805.6	23788.4	-1.338	59.696	-0.716	4.937	-60.639	11.705	.000
132.0	974690.9	23789.7	-1.341	59.694	-0.701	4.903	-60.557	11.708	.000
134.0	973574.6	23791.1	-1.343	59.692	-0.699	4.868	-60.475	11.711	.000
136.0	972456.6	23792.5	-1.345	59.691	-0.685	4.841	-60.380	11.714	.000
138.0	971337.0	23793.9	-1.347	59.689	-0.681	4.825	-60.293	11.716	.000
140.0	970215.7	23795.2	-1.349	59.688	-0.668	4.801	-60.196	11.719	.000
142.0	969092.8	23796.6	-1.351	59.687	-0.660	4.790	-60.099	11.722	.000
144.0	967968.3	23798.0	-1.353	59.686	-0.649	4.767	-59.992	11.725	.000
146.0	966842.1	23799.4	-1.355	59.685	-0.639	4.760	-59.891	11.728	.000
148.0	965714.4	23800.8	-1.357	59.684	-0.630	4.754	-59.784	11.731	.000
150.0	964585.1	23802.2	-1.359	59.684	-0.621	4.745	-59.668	11.734	.000
152.0	963454.1	23803.6	-1.361	59.683	-0.610	4.742	-59.558	11.737	.000
154.0	962321.6	23804.9	-1.363	59.683	-0.603	4.740	-59.439	11.739	.000
156.0	961187.5	23806.4	-1.365	59.683	-0.595	4.740	-59.319	11.742	.000
158.0	960051.8	23807.7	-1.367	59.683	-0.582	4.741	-59.197	11.745	.000
160.0	958914.6	23809.1	-1.369	59.683	-0.571	4.754	-59.059	11.748	.000
162.0	957775.7	23810.5	-1.371	59.683	-0.567	4.774	-58.937	11.751	.000
164.0	956635.3	23812.0	-1.373	59.684	-0.553	4.781	-58.805	11.754	.000
166.0	955493.4	23813.3	-1.375	59.684	-0.549	4.798	-58.668	11.757	.000
168.0	954349.9	23814.8	-1.377	59.685	-0.539	4.821	-58.522	11.760	.000
170.0	953204.9	23816.2	-1.379	59.686	-0.524	4.844	-58.385	11.763	.000
172.0	952058.3	23817.6	-1.381	59.687	-0.520	4.866	-58.235	11.766	.000
174.0	950910.2	23819.0	-1.383	59.688	-0.506	4.888	-58.090	11.769	.000
176.0	949760.6	23820.4	-1.385	59.689	-0.499	4.923	-57.938	11.772	.000
178.0	948609.5	23821.8	-1.387	59.690	-0.499	4.963	-57.787	11.775	.000



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 * ST19BET USING FLAIR19, INERTIAL-BT19019, NPO264 DYN. DATA. *

 * PAGE 4 *

TIME (SEC)	ALTUE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
180.0	947456.6	23823.3	-1.389	59.692	-.480	5.001	-57.623	11.778	.000
182.0	946302.6	23824.7	-1.391	59.693	-.481	5.045	-57.464	11.781	.000
184.0	945146.9	23826.1	-1.393	59.695	-.492	5.094	-57.301	11.784	.000
186.0	943989.7	23827.5	-1.395	59.697	-.542	5.156	-57.127	11.787	.000
188.0	942831.1	23829.0	-1.397	59.699	-.601	5.229	-56.947	11.790	.000
190.0	941670.9	23830.4	-1.399	59.701	-.646	5.293	-56.769	11.794	.000
192.0	940509.3	23831.8	-1.401	59.703	-.700	5.366	-56.586	11.797	.000
194.0	939346.2	23833.2	-1.402	59.706	-.757	5.444	-56.401	11.800	.000
196.0	938181.7	23834.7	-1.404	59.708	-.810	5.518	-56.227	11.803	.000
198.0	937015.7	23836.1	-1.406	59.711	-.865	5.597	-56.098	11.806	.000
200.0	935848.2	23837.6	-1.408	59.714	-.921	5.683	-55.962	11.809	.000
202.0	934679.3	23839.0	-1.410	59.717	-.972	5.769	-55.825	11.812	.000
204.0	933509.0	23840.5	-1.412	59.720	-1.064	5.852	-55.679	11.815	.000
206.0	932337.2	23841.9	-1.414	59.723	-1.096	5.849	-55.527	11.819	.000
208.0	931164.0	23843.3	-1.415	59.727	-1.124	5.842	-55.370	11.822	.000
210.0	929989.4	23844.8	-1.417	59.730	-1.153	5.845	-55.212	11.825	.000
212.0	928813.3	23846.2	-1.419	59.734	-1.179	5.843	-55.047	11.828	.000
214.0	927635.8	23847.7	-1.421	59.738	-1.206	5.855	-54.907	11.831	.000
216.0	926456.9	23849.2	-1.423	59.742	-1.237	5.859	-54.800	11.835	.000
218.0	925276.7	23850.6	-1.425	59.746	-1.263	5.865	-54.680	11.838	.000
220.0	924095.0	23852.1	-1.426	59.750	-1.219	5.789	-54.558	11.841	.000
222.0	922911.9	23853.5	-1.428	59.755	-1.159	5.688	-54.440	11.844	.000
224.0	921727.4	23855.0	-1.430	59.759	-1.102	5.593	-54.309	11.848	.000
226.0	920541.0	23856.4	-1.432	59.764	-1.037	5.501	-54.178	11.851	.000
228.0	919354.4	23857.9	-1.433	59.769	-.976	5.421	-54.047	11.854	.000
230.0	918165.9	23859.4	-1.435	59.774	-.913	5.325	-53.913	11.858	.000
232.0	916975.9	23860.8	-1.437	59.779	-.855	5.247	-53.767	11.861	.000
234.0	915784.7	23862.3	-1.439	59.784	-.797	5.175	-53.628	11.864	.000
236.0	914592.1	23863.8	-1.440	59.789	-.727	5.093	-53.485	11.868	.000
238.0	913398.2	23865.2	-1.442	59.795	-.675	5.020	-53.336	11.871	.000

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ST198ET USING FLAIR19, INERTIAL-BT19019, NP0264 DYN. DATA.

ORIGINAL PAGE IS
OF POOR QUALITY

 * SI198ET USING FLAIR19, INERTIAL-BT19D19, NP0264 DYN. DATA. *
 * PAGE 6 *

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
300.0	875750.4	23911.5	-1.492	60.035	-.637	3.704	-29.833	11.981	.000
302.0	874516.7	23913.1	-1.493	60.045	-.650	3.696	-28.693	11.985	.000
304.0	873231.7	23914.6	-1.495	60.055	-.640	3.680	-27.553	11.989	.000
306.0	872045.7	23916.1	-1.496	60.065	-.656	3.676	-26.414	11.993	.000
308.0	870808.5	23917.6	-1.498	60.076	-.659	3.667	-25.266	11.997	.000
310.0	869570.2	23919.2	-1.499	60.086	-.664	3.672	-24.116	12.001	.000
312.0	868330.8	23920.7	-1.500	60.097	-.677	3.691	-22.966	12.004	.000
314.0	867090.3	23922.2	-1.502	60.108	-.679	3.685	-21.812	12.008	.000
316.0	865848.7	23923.8	-1.503	60.119	-.698	3.695	-20.661	12.012	.000
318.0	864606.1	23925.3	-1.505	60.130	-.717	3.696	-19.498	12.016	.000
320.0	863362.3	23926.8	-1.506	60.141	-.740	3.711	-18.332	12.020	.000
322.0	862117.5	23928.4	-1.507	60.153	-.747	3.719	-17.164	12.024	.000
324.0	860871.6	23929.9	-1.509	60.164	-.774	3.728	-15.992	12.028	.000
326.0	859624.7	23931.4	-1.510	60.176	-.782	3.737	-14.815	12.032	.000
328.0	858376.6	23933.0	-1.512	60.188	-.798	3.750	-13.641	12.036	.000
330.0	857127.5	23934.5	-1.513	60.200	-.824	3.766	-12.461	12.040	.000
332.0	855877.4	23936.1	-1.514	60.212	-.853	3.784	-11.280	12.044	.000
334.0	854626.3	23937.6	-1.516	60.224	-.887	3.802	-10.094	12.048	.000
336.0	853374.0	23939.2	-1.517	60.236	-.938	3.828	-8.897	12.052	.000
338.0	852120.8	23940.7	-1.518	60.249	-.974	3.852	-7.695	12.057	.000
340.0	850866.5	23942.3	-1.520	60.262	-1.005	3.873	-6.495	12.061	.000
342.0	849611.3	23943.8	-1.521	60.275	-1.031	3.891	-5.271	12.065	.000
344.0	848355.0	23945.4	-1.522	60.288	-1.078	3.916	-4.036	12.069	.000
346.0	847097.7	23946.9	-1.523	60.301	-1.128	3.943	-2.802	12.073	.000
348.0	845839.4	23948.5	-1.525	60.314	-1.168	3.951	-1.553	12.077	.000
350.0	844580.1	23950.0	-1.526	60.327	-1.240	3.967	-.294	12.082	.000
352.0	843319.9	23951.6	-1.527	60.341	-1.368	3.935	.980	12.086	.000
354.0	842058.7	23953.2	-1.529	60.354	-1.519	3.876	2.261	12.090	.000
356.0	840796.5	23954.7	-1.530	60.368	-1.674	3.806	3.546	12.094	.000
358.0	839533.3	23956.3	-1.531	60.382	-1.864	3.696	4.844	12.099	.000

 * ST19RET USING FLA1K19, INERTIAL-BT19D19, NPO264 DYN. DATA. *
 * PAGE 7 *

TIME (SEC)	ALTIDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
360.0	838269.2	23957.3	-1.532	60.396	-2.050	3.575	6.154	12.103	.000
362.0	837004.1	23959.4	-1.533	60.410	-2.242	3.452	7.466	12.107	.000
364.0	835738.0	23961.0	-1.535	60.425	-2.438	3.325	8.792	12.112	.000
366.0	834471.1	23962.5	-1.536	60.439	-2.647	3.197	10.117	12.116	.000
368.0	833203.2	23964.1	-1.537	60.454	-2.824	3.056	11.452	12.121	.000
370.0	831934.4	23965.7	-1.538	60.469	-3.028	2.898	12.800	12.125	.000
372.0	830664.7	23967.2	-1.539	60.484	-3.254	2.700	14.150	12.129	.000
374.0	829394.0	23968.8	-1.541	60.499	-3.482	2.481	15.512	12.134	.000
376.0	828122.5	23970.4	-1.542	60.514	-3.709	2.258	16.876	12.138	.000
378.0	826850.0	23972.0	-1.543	60.530	-3.885	2.055	18.250	12.143	.000
380.0	825576.9	23973.6	-1.543	60.545	-3.858	1.937	19.237	12.147	.000
382.0	824303.3	23975.1	-1.545	60.561	-3.806	1.868	19.475	12.152	.000
384.0	823028.8	23976.7	-1.546	60.577	-3.740	1.801	19.680	12.157	.000
386.0	821753.5	23978.3	-1.547	60.593	-3.687	1.732	19.878	12.161	.000
388.0	820477.3	23979.9	-1.548	60.609	-3.616	1.674	20.024	12.166	.000
390.0	819200.2	23981.5	-1.549	60.625	-3.569	1.606	20.182	12.170	.000
392.0	817922.3	23983.1	-1.550	60.641	-3.517	1.549	20.352	12.175	.000
394.0	816643.5	23984.6	-1.551	60.658	-3.466	1.485	20.494	12.180	.000
396.0	815364.0	23986.2	-1.552	60.675	-3.411	1.425	20.614	12.185	.000
398.0	814083.5	23987.8	-1.553	60.692	-3.361	1.364	20.753	12.189	.000
400.0	812802.3	23989.4	-1.554	60.709	-3.313	1.307	20.898	12.194	.000
402.0	811520.3	23991.0	-1.555	60.726	-3.271	1.251	21.054	12.199	.000
404.0	810237.4	23992.6	-1.556	60.743	-3.231	1.197	21.223	12.204	.000
406.0	808953.8	23994.2	-1.557	60.760	-3.191	1.142	21.391	12.209	.000
408.0	807669.4	23995.7	-1.558	60.778	-3.145	1.089	21.511	12.213	.000
410.0	806384.2	23997.4	-1.559	60.796	-3.102	1.041	21.643	12.218	.000
412.0	805098.1	23999.0	-1.560	60.813	-3.065	.988	21.783	12.223	.000
414.0	803811.3	24000.5	-1.561	60.831	-3.023	.939	21.934	12.228	.000
416.0	802523.8	24002.1	-1.562	60.850	-2.988	.891	22.087	12.233	.000
418.0	801235.4	24003.7	-1.563	60.868	-2.955	.844	22.251	12.238	.000

ORIGINAL PAGE IS
 OF POOR QUALITY

TIME (SEC)	ALTOR (FT)	VELA (FPS)	GAMA (DEG)	HOGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
420.0	799946.4	24005.3	-1.564	60.866	-2.915	.796	22.404	12.243	.000
422.0	798656.7	24006.9	-1.565	60.905	-2.886	.758	22.355	12.248	.000
424.0	797366.2	24003.5	-1.566	60.924	-2.864	.711	22.315	12.253	.000
426.0	796075.0	24010.1	-1.567	60.942	-2.832	.674	22.270	12.258	.000
428.0	794783.0	24011.7	-1.568	60.961	-2.809	.630	22.249	12.264	.000
430.0	793490.4	24013.3	-1.569	60.981	-2.782	.593	22.231	12.269	.000
432.0	792197.0	24014.9	-1.570	61.000	-2.754	.546	22.218	12.274	.000
434.0	790902.9	24016.5	-1.571	61.019	-2.731	.509	22.228	12.279	.000
436.0	789608.1	24018.2	-1.572	61.039	-2.714	.475	22.231	12.284	.000
438.0	788312.6	24019.8	-1.573	61.059	-2.690	.439	22.249	12.290	.000
440.0	787016.5	24021.4	-1.573	61.078	-2.675	.411	22.281	12.295	.000
442.0	785719.6	24023.0	-1.574	61.098	-2.662	.378	22.315	12.300	.000
444.0	784422.0	24024.6	-1.575	61.119	-2.645	.355	22.372	12.306	.000
446.0	783123.6	24026.2	-1.576	61.139	-2.631	.327	22.433	12.311	.000
448.0	781824.9	24027.8	-1.577	61.159	-2.611	.302	22.502	12.316	.000
450.0	780525.3	24029.4	-1.578	61.180	-2.598	.280	22.588	12.322	.000
452.0	779225.1	24031.0	-1.579	61.201	-2.595	.253	22.670	12.327	.000
454.0	777924.3	24032.6	-1.579	61.222	-2.588	.235	22.768	12.333	.000
456.0	776622.8	24034.2	-1.580	61.243	-2.584	.211	22.874	12.338	.000
458.0	775320.7	24035.9	-1.581	61.264	-2.575	.189	22.996	12.344	.000
460.0	774017.9	24037.5	-1.582	61.285	-2.573	.162	23.118	12.350	.000
462.0	772714.6	24039.1	-1.583	61.307	-2.580	.139	23.260	12.355	.000
464.0	771410.6	24040.7	-1.583	61.328	-2.589	.119	23.403	12.361	.000
466.0	770106.1	24042.3	-1.584	61.350	-2.593	.100	23.555	12.367	.000
468.0	768800.9	24044.0	-1.585	61.372	-2.607	.074	23.723	12.372	.000
470.0	767495.1	24045.6	-1.586	61.394	-2.622	.049	23.897	12.378	.000
472.0	766186.7	24047.2	-1.586	61.416	-2.641	.031	24.036	12.384	.000
474.0	764881.8	24048.8	-1.587	61.439	-2.662	.003	24.281	12.390	.000
476.0	763574.3	24050.4	-1.588	61.461	-2.693	-.023	24.480	12.396	.000
478.0	762266.2	24052.1	-1.589	61.484	-2.714	-.047	24.694	12.402	.000

ST198ET USING FLAIR19, INERTIAL-BTI9D19, NP0264 DYN. DATA.

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 * ST198EF USING FLAIR19, INERTIAL-BT19D19, NP0264 DYN. DATA. *
 * PAGE 10 *

TIME (SEC)	ALTUE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
540.0	721476.4	24102.8	-1.606	62.259	-3.010	.426	30.337	12.604	.000
542.0	720154.1	24104.4	-1.607	62.286	-2.982	.500	30.531	12.611	.000
544.0	718831.5	24106.0	-1.607	62.314	-2.955	.572	30.679	12.619	.000
546.0	717508.5	24107.7	-1.608	62.342	-2.929	.646	30.841	12.626	.000
548.0	716185.3	24109.3	-1.608	62.369	-2.905	.723	31.014	12.633	.000
550.0	714861.6	24111.0	-1.608	62.397	-2.887	.797	31.188	12.641	.000
552.0	713537.8	24112.6	-1.609	62.425	-2.872	.877	31.247	12.648	.000
554.0	712213.6	24114.2	-1.609	62.454	-2.857	.953	31.269	12.656	.000
556.0	710889.2	24115.9	-1.609	62.482	-2.841	1.032	31.297	12.663	.000
558.0	709564.5	24117.6	-1.610	62.511	-2.839	1.112	31.336	12.671	.000
560.0	708239.5	24119.2	-1.610	62.539	-2.833	1.186	31.373	12.678	.000
562.0	706914.2	24120.8	-1.610	62.568	-2.823	1.270	31.429	12.686	.000
564.0	705588.7	24122.5	-1.611	62.597	-2.828	1.349	31.492	12.694	.000
566.0	704262.8	24124.1	-1.611	62.626	-2.826	1.428	31.567	12.702	.000
568.0	702936.7	24125.8	-1.611	62.656	-2.832	1.506	31.648	12.710	.000
570.0	701610.4	24127.4	-1.612	62.685	-2.832	1.588	31.742	12.718	.000
572.0	700283.8	24129.1	-1.612	62.715	-2.844	1.667	31.842	12.726	.000
574.0	698957.1	24130.8	-1.612	62.745	-2.851	1.746	31.944	12.734	.000
576.0	697630.1	24132.4	-1.613	62.774	-2.872	1.828	32.059	12.742	.000
578.0	696302.8	24134.1	-1.613	62.805	-2.889	1.911	32.181	12.750	.000
580.0	694975.4	24135.7	-1.613	62.835	-2.912	1.962	32.313	12.758	.000
582.0	693647.6	24137.4	-1.613	62.865	-2.963	1.989	32.457	12.766	.000
584.0	692320.0	24139.0	-1.614	62.896	-3.011	1.992	32.607	12.775	.000
586.0	690991.9	24140.7	-1.614	62.926	-3.078	1.956	32.765	12.783	.000
588.0	689663.7	24142.3	-1.614	62.957	-3.148	1.918	32.934	12.792	.000
590.0	688335.3	24144.0	-1.614	62.988	-3.226	1.886	33.105	12.800	.000
592.0	687006.7	24145.6	-1.615	63.019	-3.292	1.854	33.292	12.809	.000
594.0	685678.0	24147.3	-1.615	63.050	-3.372	1.819	33.478	12.817	.000
596.0	684349.1	24148.9	-1.615	63.082	-3.456	1.784	33.684	12.826	.000
598.0	683020.0	24150.6	-1.615	63.113	-3.532	1.743	33.903	12.835	.000

 * ST198F USING FLAIR19, INERTIAL-BT19D19, NPO264 DYN. DATA. *

 * PAGE 11 *

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
600.0	681690.8	24152.2	-1.615	63.145	-3.619	1.712	34.118	12.844	.000
602.0	680301.5	24153.9	-1.615	63.177	-3.698	1.670	34.350	12.852	.000
604.0	679032.0	24155.6	-1.616	63.209	-3.806	1.583	34.591	12.861	.000
606.0	677702.5	24157.2	-1.616	63.241	-3.918	1.491	34.828	12.870	.000
608.0	676372.8	24158.9	-1.616	63.273	-4.023	1.391	35.077	12.879	.000
610.0	675043.1	24160.5	-1.616	63.306	-4.139	1.295	35.276	12.889	.000
612.0	673713.3	24162.2	-1.616	63.338	-4.246	1.203	35.248	12.898	.000
614.0	672383.5	24163.8	-1.616	63.371	-4.371	1.115	35.237	12.907	.000
616.0	671053.6	24165.5	-1.616	63.404	-4.486	1.032	35.223	12.916	.000
618.0	669723.6	24167.1	-1.616	63.437	-4.610	.930	35.232	12.926	.000
620.0	668393.5	24168.8	-1.616	63.470	-4.722	.849	35.240	12.935	.000
622.0	667063.4	24170.5	-1.616	63.504	-4.728	.846	35.270	12.945	.000
624.0	665733.2	24172.1	-1.616	63.537	-4.741	.843	35.303	12.955	.000
626.0	664402.9	24173.8	-1.616	63.571	-4.757	.837	35.354	12.964	.000
628.0	663072.6	24175.4	-1.617	63.605	-4.768	.832	35.414	12.974	.000
630.0	661742.3	24177.1	-1.617	63.639	-4.786	.835	35.473	12.984	.000
632.0	660411.9	24178.7	-1.617	63.673	-4.799	.830	35.545	12.994	.000
634.0	659081.4	24180.4	-1.617	63.707	-4.823	.830	35.634	13.004	.000
636.0	657751.0	24182.1	-1.617	63.742	-4.842	.830	35.723	13.014	.000
638.0	656420.6	24183.7	-1.617	63.776	-4.864	.834	35.814	13.024	.000
640.0	655090.2	24185.4	-1.617	63.811	-4.793	.923	35.937	13.903	.000
642.0	653759.8	24187.1	-1.616	63.846	-4.714	1.014	36.068	13.913	.000
644.0	652429.4	24188.7	-1.617	63.881	-4.631	1.104	36.202	13.923	.000
646.0	651099.0	24190.4	-1.616	63.916	-4.568	1.184	36.342	13.933	.000
648.0	649768.6	24192.0	-1.616	63.951	-4.504	1.217	36.500	13.943	.000
650.0	648438.2	24193.7	-1.616	63.987	-4.456	1.249	36.661	13.954	.000
652.0	647107.9	24195.3	-1.616	64.022	-4.406	1.282	36.837	13.964	.000
654.0	645777.7	24197.0	-1.616	64.058	-4.362	1.309	37.013	13.974	.000
656.0	644447.5	24198.7	-1.616	64.094	-4.313	1.344	37.203	13.985	.000
658.0	643117.3	24200.3	-1.616	64.130	-4.279	1.377	37.400	13.995	.000

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SUBJECT US 106-1141319- INTERNAL-BT18919. NP0264 DYN. DATA.

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***** FLA1319. INERTIAL-8T19D19. NP0264 DYN. DATA.

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 * J19BET USING FLAIR19, INERTIAL-8T19D19, NP0264 DYN. DATA. *
 * PAGE 15 *

ORIGINAL PAGE IS
 OF POOR QUALITY

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HUGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
840.0	523283.5	24350.4	-1.568	68.051	1.197	.242	39.815	15.471	.001
842.0	521989.9	24352.0	-1.567	68.101	1.106	.143	39.859	15.496	.001
844.0	520697.1	24353.7	-1.566	68.151	1.028	.050	39.920	15.520	.001
846.0	519405.0	24355.3	-1.565	68.201	.940	-.056	39.985	15.546	.001
848.0	518113.5	24356.9	-1.564	68.252	.860	-.149	40.056	15.571	.001
850.0	516822.8	24358.5	-1.563	68.302	.784	-.177	40.142	15.597	.001
852.0	515532.9	24360.1	-1.562	68.353	.779	.113	40.226	15.623	.001
854.0	514243.6	24361.8	-1.561	68.404	.692	.343	40.325	15.649	.001
856.0	512955.2	24363.4	-1.560	68.455	.229	.164	40.473	15.675	.001
858.0	511667.6	24365.0	-1.559	68.507	-.267	-.086	40.631	15.702	.001
860.0	510380.7	24366.6	-1.558	68.558	-.641	-.232	40.806	15.729	.001
862.0	509094.5	24368.2	-1.557	68.610	-.922	-.277	41.004	15.757	.001
864.0	507809.2	24369.8	-1.556	68.661	-1.207	-.332	41.188	15.785	.001
866.0	506524.7	24371.4	-1.555	68.713	-1.485	-.382	41.297	15.813	.001
868.0	505241.0	24373.0	-1.554	68.765	-1.774	-.442	41.274	15.841	.001
870.0	503958.2	24374.7	-1.552	68.817	-1.858	-.402	41.242	15.870	.001
872.0	502676.3	24376.3	-1.551	68.870	-1.659	-.199	41.123	15.899	.001
874.0	501395.2	24377.9	-1.550	68.922	-1.482	-.102	40.992	15.928	.001
876.0	500114.9	24379.5	-1.549	68.975	-1.306	-.023	40.871	15.958	.001
878.0	498835.4	24381.1	-1.548	69.027	-1.119	.062	40.770	15.988	.001
880.0	497556.8	24382.7	-1.547	69.080	-.964	.136	40.668	16.018	.001
882.0	496279.1	24384.3	-1.546	69.133	-.801	.214	40.579	16.049	.001
884.0	495002.2	24385.9	-1.545	69.186	-.625	.298	40.494	16.080	.001
886.0	493726.1	24387.5	-1.543	69.240	-.465	.373	40.428	16.112	.001
888.0	492450.9	24389.1	-1.542	69.293	-.319	.427	40.369	16.144	.001
890.0	491176.6	24390.7	-1.541	69.347	-.192	.377	40.309	16.176	.002
892.0	489903.1	24392.3	-1.540	69.401	-.076	.331	40.265	16.209	.002
894.0	488630.6	24393.9	-1.539	69.455	.044	.280	40.220	16.242	.002
896.0	487358.9	24395.5	-1.538	69.509	.166	.232	40.191	16.275	.002
898.0	486086.1	24397.1	-1.536	69.563	.283	.179	40.167	16.309	.002

 * ST198ET USING FLAIR19, INERTIAL-3119D19, NPO264 DYN. DATA. *
 * PAGE 16 *****

TIME (SEC)	ALTD (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
900.0	484818.3	24398.7	-1.535	69.617	.400	.137	40.155	16.344	.002
902.0	483549.4	24400.3	-1.534	69.672	.508	.087	40.144	16.378	.002
904.0	492281.3	24401.9	-1.533	69.727	.604	.031	40.145	16.413	.002
906.0	481014.3	24403.5	-1.531	69.781	.714	-.021	40.155	16.449	.002
908.0	479748.1	24405.1	-1.530	69.836	.815	-.072	40.176	16.485	.002
910.0	478483.0	24406.6	-1.529	69.892	.947	.028	40.202	16.522	.002
912.0	477218.7	24408.2	-1.528	69.947	1.104	.235	40.242	16.559	.002
914.0	475955.5	24409.8	-1.526	70.002	1.160	.358	40.295	16.596	.002
916.0	474693.2	24411.4	-1.525	70.058	1.080	.363	40.370	16.634	.002
918.0	473431.8	24413.0	-1.524	70.113	.998	.363	40.457	16.672	.002
920.0	472171.4	24414.6	-1.523	70.169	.914	.360	40.550	16.711	.002
922.0	470912.1	24416.2	-1.521	70.225	.828	.365	40.658	16.751	.002
924.0	469653.7	24417.7	-1.520	70.281	.744	.365	40.768	16.791	.002
926.0	468396.4	24419.3	-1.519	70.338	.648	.360	40.886	16.831	.002
928.0	467140.0	24420.9	-1.517	70.394	.549	.355	41.017	16.872	.002
930.0	465884.7	24422.4	-1.516	70.451	.462	.350	41.127	16.914	.003
932.0	464630.4	24424.0	-1.515	70.508	.359	.343	41.212	16.956	.003
934.0	463377.1	24425.6	-1.513	70.564	.249	.335	41.131	16.999	.003
936.0	462124.9	24427.2	-1.512	70.621	.095	.101	41.031	17.042	.003
938.0	460873.6	24428.7	-1.510	70.678	-.083	-.176	40.939	17.086	.003
940.0	459623.7	24430.3	-1.509	70.736	-.093	-.287	40.871	17.130	.003
942.0	458374.7	24431.9	-1.508	70.793	.080	-.237	40.838	17.175	.003
944.0	457126.7	24433.4	-1.506	70.851	.224	-.199	40.814	17.221	.003
946.0	455879.8	24435.0	-1.505	70.909	.384	-.151	40.793	17.267	.003
948.0	454634.0	24436.6	-1.503	70.967	.534	-.107	40.781	17.314	.003
950.0	453389.3	24438.1	-1.502	71.025	.681	-.058	40.781	17.362	.003
952.0	452145.6	24439.7	-1.501	71.083	.830	-.021	40.787	17.410	.003
954.0	450903.1	24441.3	-1.499	71.141	.966	.019	40.799	17.459	.004
956.0	449661.6	24442.8	-1.498	71.199	1.109	.070	40.817	17.509	.004
958.0	448421.2	24444.4	-1.496	71.258	1.241	.112	40.854	17.559	.004

ST198ET USING FLAIR19, INERTIAL-BT19019, NP0264 DYN. DATA.

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 * ST198T USING FLAIR19, INERTIAL-BT19D19, NP0264 DYN. DATA. *
 * PAGE 18 *****

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETA A (DEG)	ALPHA A (DEG)	MACHA (-)	QA (PSF)
1020.0	410501.1	24491.9	-1.446	73.145	1.181	.141	40.653	19.587	.011
1022.0	409360.0	24493.4	-1.445	73.208	1.217	.266	40.602	19.671	.011
1024.0	408160.3	24494.9	-1.443	73.271	1.260	.400	40.559	19.754	.012
1026.0	406961.9	24496.4	-1.441	73.334	1.179	.418	40.528	19.839	.012
1028.0	405765.0	24497.9	-1.439	73.398	.975	.331	40.529	19.924	.013
1030.0	404569.3	24499.4	-1.438	73.461	.775	.245	40.527	20.010	.013
1032.0	403375.0	24500.9	-1.436	73.525	.569	.156	40.539	20.097	.014
1034.0	402182.0	24502.4	-1.434	73.589	.358	.067	40.554	20.184	.015
1036.0	400990.5	24503.9	-1.432	73.653	.144	-.030	40.577	20.273	.015
1038.0	399800.3	24505.4	-1.430	73.717	-.081	-.123	40.605	20.362	.016
1040.0	398611.5	24506.9	-1.429	73.781	-.310	-.221	40.637	20.451	.017
1042.0	397424.1	24508.4	-1.427	73.846	-.542	-.325	40.633	20.541	.017
1044.0	396238.1	24509.9	-1.425	73.910	-.696	-.353	40.737	20.632	.018
1046.0	395053.6	24511.3	-1.423	73.975	-.709	-.245	40.824	20.723	.019
1048.0	393870.4	24512.8	-1.421	74.040	-.723	-.141	40.912	20.815	.020
1050.0	392688.7	24514.3	-1.419	74.105	-.750	-.045	40.981	20.907	.021
1052.0	391509.4	24515.7	-1.417	74.170	-.787	.049	41.023	21.000	.021
1054.0	390329.6	24517.2	-1.416	74.235	-.829	.192	41.055	21.093	.022
1056.0	389152.2	24518.7	-1.414	74.300	-.919	.043	41.040	21.186	.023
1058.0	387976.3	24520.1	-1.412	74.366	-1.043	-.261	41.031	21.279	.025
1060.0	386801.9	24521.6	-1.410	74.431	-.897	-.305	40.959	21.373	.026
1062.0	385629.0	24523.1	-1.408	74.497	-.705	-.303	40.866	21.467	.027
1064.0	384457.6	24524.5	-1.406	74.563	-.525	-.298	40.776	21.561	.028
1066.0	383297.6	24526.0	-1.404	74.629	-.326	-.295	40.702	21.655	.030
1068.0	382119.1	24527.5	-1.402	74.695	-.148	-.294	40.627	21.749	.031
1070.0	380952.1	24528.9	-1.400	74.761	.029	-.297	40.561	21.843	.032
1072.0	379786.6	24530.4	-1.398	74.827	.197	-.309	40.500	21.937	.034
1074.0	378622.6	24531.8	-1.396	74.894	.370	-.314	40.442	22.031	.036
1076.0	377460.2	24533.2	-1.394	74.961	.584	-.069	40.390	22.124	.037
1078.0	376299.2	24534.7	-1.392	75.027	.788	.183	40.334	22.218	.039

ST19BET USING FLAIR19, INERTIAL-8T19D19, NP0264 DYN. DATA.

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 * ST198ET USING FLAIR19, INERTIAL-BT19D19, NP0264 DYN. DATA. *
 * PAGE 20 *

TIME (SEC)	ALTUD (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA A (DEG)	MACHA (-)	QA (PSF)
1140.0	341115.9	24576.9	-1.324	77.157	-.186	-.198	40.753	24.712	.185
1142.0	340009.1	24578.2	-1.322	77.228	.025	-.172	40.706	24.771	.195
1144.0	338904.3	24579.4	-1.320	77.299	.236	-.148	40.635	24.828	.205
1146.0	337801.3	24580.6	-1.317	77.369	.444	-.131	40.558	24.884	.216
1148.0	336700.4	24581.8	-1.315	77.440	.658	-.115	40.451	24.938	.227
1150.0	335601.4	24583.0	-1.312	77.512	.874	-.056	40.329	24.990	.239
1152.0	334504.4	24584.2	-1.309	77.583	1.137	.224	40.188	25.041	.252
1154.0	333409.4	24585.4	-1.307	77.654	1.191	.305	40.036	25.090	.265
1156.0	332316.5	24586.5	-1.304	77.725	1.073	.231	39.885	25.137	.279
1158.0	331225.6	24587.7	-1.302	77.797	.935	.138	39.706	25.182	.294
1160.0	330136.9	24588.8	-1.299	77.868	.784	.052	39.504	25.225	.309
1162.0	329050.3	24589.9	-1.296	77.940	.628	-.048	39.269	25.267	.325
1164.0	327965.7	24591.1	-1.294	78.012	.442	-.156	39.263	25.307	.348
1166.0	326883.3	24592.2	-1.291	78.084	.232	-.282	39.248	25.345	.366
1168.0	325803.1	24593.3	-1.288	78.156	.066	-.373	39.225	25.381	.385
1170.0	324725.0	24594.3	-1.285	78.228	.079	-.326	39.250	25.416	.405
1172.0	323649.3	24595.4	-1.283	78.300	.068	-.289	39.316	25.449	.427
1174.0	322575.7	24596.5	-1.280	78.373	.059	-.271	39.462	25.480	.448
1176.0	321504.4	24597.5	-1.277	78.445	.016	-.256	39.578	25.509	.472
1178.0	320435.5	24598.5	-1.274	78.518	-.037	-.270	39.658	25.537	.496
1180.0	319369.0	24599.4	-1.271	78.590	-.115	-.289	39.711	25.563	.522
1182.0	318304.9	24600.4	-1.268	78.663	-.226	-.325	39.720	25.588	.549
1184.0	317243.3	24601.3	-1.264	78.736	-.358	-.383	39.705	25.611	.578
1186.0	316184.2	24602.1	-1.261	78.809	-.516	-.451	39.647	25.632	.607
1188.0	315127.6	24603.0	-1.258	78.882	-.703	-.548	39.625	25.653	.638
1190.0	314073.7	24603.9	-1.255	78.955	-.604	-.381	39.609	25.671	.671
1192.0	313022.3	24604.8	-1.252	79.029	-.509	-.214	39.564	25.688	.706
1194.0	311973.5	24605.6	-1.248	79.102	-.440	-.061	39.633	25.704	.741
1196.0	310927.4	24606.4	-1.245	79.175	-.403	.059	39.701	25.719	.780
1198.0	309884.0	24607.2	-1.242	79.249	-.407	.162	39.754	25.732	.820

FLORBIT USING FLAIR19, INERTIAL-BTJ9D19, NP0264 DYN. DATA.

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 * ST198ET USING FLAIR19, INERTIAL-BT19019, NP0264 DYN. DATA. *

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TIME (SEC)	ALTIDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
1260.0	279230.9	24714.1	-1.081	81.691	.769	-.212	39.289	27.191	4.107
1262.0	278371.6	24698.8	-1.073	81.736	.573	-.357	39.717	27.214	4.317
1264.0	277464.7	24678.7	-1.065	81.776	.429	-.220	40.285	27.228	4.535
1266.0	276575.7	24642.7	-1.057	81.749	.210	-.180	40.858	27.221	4.754
1268.0	275690.0	24622.6	-1.047	81.843	-.150	-.221	41.265	27.227	4.987
1270.0	274813.2	24605.5	-1.038	81.892	-.632	-.349	41.309	27.233	5.230
1272.0	273945.2	24595.9	-1.027	81.953	-1.133	-.491	41.387	27.244	5.484
1274.0	273086.6	24583.2	-1.016	82.010	-1.557	-.558	41.138	27.248	5.746
1276.0	272238.2	24571.5	-1.005	82.068	-1.911	-.564	39.525	27.250	6.016
1278.0	271396.9	24560.2	-.994	82.128	-2.183	-.518	39.201	27.249	6.294
1280.0	270569.5	24549.5	-.983	82.188	-2.212	-.308	38.958	27.246	6.581
1282.0	269750.0	24538.8	-.971	82.249	-2.055	-.159	38.963	27.241	6.876
1284.0	268940.9	24528.4	-.959	82.312	-.902	.632	39.174	27.232	7.180
1286.0	268142.6	24517.7	-.947	82.376	-.588	-.015	39.747	27.221	7.490
1288.0	267355.7	24506.5	-.933	82.441	-.252	-.267	40.179	27.207	7.808
1290.0	266581.0	24495.8	-.919	82.507	.104	-.314	40.304	27.191	8.133
1292.0	265812.5	24485.4	-.905	82.576	.508	-.308	40.120	27.174	8.464
1294.0	265068.5	24475.2	-.890	82.645	.854	-.118	39.828	27.155	8.802
1296.0	264331.2	24465.2	-.875	82.716	.950	-.083	39.639	27.134	9.146
1298.0	263607.1	24455.0	-.860	82.788	.853	-.222	39.490	27.111	9.494
1300.0	262896.4	24445.7	-.844	82.862	.763	-.375	39.553	27.087	9.848
1302.0	262199.5	24436.6	-.827	82.937	.827	-.308	39.838	27.063	10.207
1304.0	261517.0	24427.5	-.810	83.013	.953	-.163	40.371	27.037	10.568
1306.0	260849.7	24418.5	-.792	83.090	.979	-.144	40.895	27.010	10.933
1308.0	260195.0	24409.4	-.773	83.170	.905	-.211	41.259	26.982	11.299
1310.0	259562.7	24400.3	-.754	83.248	.838	-.294	41.457	26.954	11.666
1312.0	258944.3	24391.4	-.734	83.328	.867	-.302	41.487	26.924	12.033
1314.0	258343.2	24382.6	-.713	83.408	.961	-.253	41.379	26.895	12.398
1316.0	257759.6	24374.0	-.693	83.489	.993	-.167	41.159	26.865	12.763
1318.0	257193.9	24366.0	-.672	83.569	.918	-.182	40.783	26.836	13.123

 * ST198ET USING FLAIR19, INERTIAL-8T19D19, NPO264 DYN. DATA. *
 * ***** PAGE 23 *****

TIME (SEC)	ALTUE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
1320.0	250646.4	24357.6	-650	83.650	.812	-.215	40.243	26.806	13.483
1322.0	250117.6	24349.3	-626	83.733	.726	-.234	39.707	26.776	13.836
1324.0	255607.5	24341.2	-606	83.816	.687	-.212	39.279	26.746	14.185
1326.0	255116.4	24333.1	-583	83.899	.667	-.170	39.151	26.716	14.527
1328.0	254644.6	24324.9	-560	83.984	.544	.117	39.211	26.687	14.861
1330.0	254192.4	24316.1	-537	84.069	-1.344	1.340	39.332	26.657	15.187
1332.0	253760.5	24307.2	-512	84.152	-6.472	.712	40.077	26.627	15.503
1334.0	253349.7	24297.7	-487	84.232	-12.550	.018	40.647	26.598	15.807
1336.0	252960.8	24287.6	-461	84.309	-18.520	-.061	41.002	26.568	16.098
1338.0	252593.3	24277.4	-436	84.383	-24.450	-.046	41.067	26.539	16.376
1340.0	252246.7	24267.0	-412	84.454	-30.382	.030	40.863	26.511	16.641
1342.0	251920.0	24256.7	-389	84.523	-36.573	.042	40.461	26.483	16.893
1344.0	251611.7	24246.5	-369	84.589	-43.037	.031	39.923	26.457	17.134
1346.0	251320.0	24236.4	-350	84.652	-49.660	-.065	39.496	26.431	17.363
1348.0	251042.7	24226.3	-335	84.712	-55.976	-.490	39.288	26.405	17.583
1350.0	250777.4	24216.4	-321	84.771	-60.175	-.977	39.201	26.381	17.795
1352.0	250522.9	24206.1	-309	84.828	-62.398	-.469	39.210	26.356	17.999
1354.0	250278.4	24195.6	-298	84.885	-64.324	-.198	39.316	26.332	18.196
1356.0	250043.3	24185.0	-287	84.940	-66.321	-.202	39.502	26.307	18.386
1358.0	249816.6	24174.0	-277	84.995	-68.069	-.380	39.705	26.283	18.569
1360.0	249597.9	24162.9	-268	85.049	-69.365	-.339	39.864	26.259	18.747
1362.0	249386.4	24151.6	-260	85.103	-70.345	-.312	39.987	26.235	18.920
1364.0	249131.8	24140.1	-252	85.156	-71.193	-.231	40.030	26.211	19.087
1366.0	248983.7	24128.4	-245	85.208	-72.025	-.265	40.023	26.188	19.249
1368.0	248791.6	24116.7	-238	85.260	-72.547	-.327	39.982	26.164	19.406
1370.0	248605.1	24105.0	-231	85.312	-72.834	-.246	39.938	26.141	19.560
1372.0	248424.1	24093.2	-225	85.364	-73.088	-.194	39.906	26.118	19.709
1374.0	248248.4	24081.3	-218	85.415	-73.447	-.249	40.021	26.095	19.853
1376.0	248077.9	24069.1	-212	85.465	-73.689	-.248	40.254	26.072	19.994
1378.0	247912.3	24056.6	-206	85.515	-73.828	-.197	40.422	26.049	20.129

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 * ST198ET USING FLAIR19, INERTIAL-8T19D19, NP0264 DYN. DATA. *

 * PAGE 24 *

TIME (SEC)	ALTIDE (FT)	VFLA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETA A (DEG)	ALPHA A (DEG)	MACHA (-)	QA (PSF)
1350.0	247751.6	24043.9	-201	85.565	-73.970	-189	40.451	26.026	20.261
1382.0	247595.6	24032.0	-195	85.616	-74.087	-185	40.318	26.004	20.390
1384.0	247444.2	24019.2	-190	85.665	-74.188	-173	40.115	25.981	20.514
1386.0	247297.2	24006.6	-185	85.714	-74.461	-108	39.933	25.959	20.634
1388.0	247154.4	23994.0	-180	85.762	-74.908	-116	39.799	25.937	20.751
1390.0	247015.5	23981.4	-175	85.811	-75.647	-084	39.740	25.915	20.864
1392.0	246880.0	23968.7	-172	85.859	-76.565	-187	39.759	25.893	20.975
1394.0	246747.1	23955.8	-169	85.907	-77.372	-222	39.830	25.871	21.083
1396.0	246616.6	23942.9	-166	85.954	-78.031	-178	39.895	25.849	21.188
1398.0	246487.8	23929.7	-164	86.001	-78.568	-218	39.954	25.828	21.293
1400.0	246360.5	23916.5	-163	86.047	-78.922	-211	39.990	25.806	21.395
1402.0	246234.4	23903.1	-161	86.093	-79.233	-212	39.988	25.784	21.497
1404.0	246109.3	23889.6	-160	86.139	-79.560	-261	39.956	25.762	21.598
1406.0	245934.9	23876.1	-159	86.184	-79.754	-256	39.918	25.739	21.699
1408.0	245861.0	23862.5	-159	86.229	-79.807	-193	39.892	25.717	21.799
1410.0	245737.4	23848.9	-159	86.274	-79.867	-178	39.867	25.695	21.899
1412.0	245614.0	23835.2	-158	86.319	-79.967	-225	39.840	25.673	21.999
1414.0	245490.7	23821.4	-158	86.364	-79.973	-238	39.856	25.650	22.100
1416.0	245367.3	23807.5	-159	86.408	-79.840	-283	39.906	25.628	22.200
1418.0	245243.7	23793.4	-159	86.452	-79.425	-311	39.953	25.605	22.301
1420.0	245120.1	23779.3	-158	86.495	-78.842	-280	39.961	25.582	22.402
1422.0	244996.7	23765.2	-158	86.539	-78.199	-300	39.875	25.559	22.503
1424.0	244873.6	23751.1	-157	86.583	-77.576	-202	39.786	25.537	22.603
1426.0	244751.5	23737.0	-156	86.626	-77.110	-236	39.749	25.514	22.704
1428.0	244630.0	23722.9	-156	86.670	-76.572	-255	39.729	25.491	22.804
1430.0	244509.3	23708.8	-154	86.714	-75.977	-279	39.721	25.469	22.903
1432.0	244389.9	23695.3	-153	86.758	-75.430	-155	39.726	25.447	23.003
1434.0	244271.7	23681.1	-151	86.802	-75.182	-192	39.740	25.424	23.100
1436.0	244154.9	23666.7	-149	86.845	-74.902	-221	39.756	25.401	23.195
1438.0	244039.5	23652.3	-148	86.887	-74.526	-220	39.761	25.379	23.290

ST198ET USING FLAIR19, INERTIAL-BT19019, NP0264 DYN. DATA.

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TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
1440.0	243925.6	23637.8	-146	86.930	-74.131	-232	39.768	25.356	23.383
1442.0	243813.2	23623.1	-144	86.973	-73.799	-157	39.772	25.333	23.474
1444.0	243702.6	23608.4	-142	87.015	-73.615	-178	39.732	25.310	23.563
1446.0	243593.6	23593.7	-140	87.057	-73.379	-179	39.667	25.288	23.651
1448.0	243486.3	23578.9	-137	87.099	-73.089	-136	39.583	25.265	23.737
1450.0	243330.8	23564.2	-135	87.141	-72.902	-096	39.546	25.243	23.821
1452.0	243276.9	23549.4	-133	87.182	-72.764	-092	39.532	25.220	23.904
1454.0	243174.6	23534.6	-131	87.224	-72.640	-095	39.534	25.198	23.985
1456.0	243073.9	23519.6	-129	87.265	-72.529	-080	39.543	25.175	24.064
1458.0	242974.8	23504.6	-127	87.306	-72.439	-066	39.559	25.153	24.141
1460.0	242877.2	23489.5	-126	87.347	-72.370	-043	39.564	25.130	24.217
1462.0	242731.1	23474.3	-124	87.387	-72.352	-034	39.554	25.108	24.291
1464.0	242636.3	23459.0	-122	87.428	-72.415	-041	39.534	25.086	24.364
1466.0	242592.7	23443.8	-121	87.468	-72.534	-061	39.519	25.063	24.435
1468.0	242500.1	23428.5	-120	87.508	-72.655	-047	39.513	25.041	24.506
1470.0	242408.2	23413.3	-119	87.548	-72.786	-034	39.529	25.019	24.576
1472.0	242316.7	23398.3	-119	87.589	-73.010	-048	39.542	24.997	24.646
1474.0	242225.3	23383.2	-119	87.629	-73.282	-078	39.540	24.975	24.716
1476.0	242133.8	23368.1	-119	87.669	-73.510	-047	39.532	24.953	24.786
1478.0	242041.8	23353.0	-120	87.709	-73.772	-016	39.537	24.931	24.856
1480.0	241948.9	23337.8	-121	87.749	-73.968	-128	39.563	24.909	24.928
1482.0	241855.2	23322.4	-122	87.788	-73.903	-034	39.579	24.886	25.000
1484.0	241760.5	23307.1	-123	87.827	-73.964	-023	39.578	24.864	25.073
1486.0	241664.8	23291.7	-125	87.866	-74.136	-060	39.566	24.841	25.148
1488.0	241567.5	23276.5	-127	87.906	-74.284	-054	39.531	24.819	25.225
1490.0	241468.6	23261.2	-129	87.944	-74.472	-054	39.526	24.796	25.304
1492.0	241367.8	23245.8	-131	87.983	-74.607	-164	39.612	24.773	25.384
1494.0	241264.8	23230.4	-134	88.022	-74.395	-158	39.682	24.750	25.468
1496.0	241159.7	23214.9	-137	88.060	-73.953	-155	39.738	24.727	25.554
1498.0	241052.6	23200.2	-139	88.101	-73.507	-148	39.802	24.704	25.644

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*ST198ET USING FLAIR19, INERTIAL-BT19D19, NP0264 DYN. DATA.

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 * ST198ET USING FLAIR19, INERTIAL-BT19D19, NPO264 DYN. DATA. *
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TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
1620.0	232448.8	22098.7	-211	90.093	-62.088	.030	40.356	22.969	33.720
1622.0	232285.6	22077.5	-212	90.117	-62.138	-.003	40.385	22.936	33.885
1624.0	232121.5	22056.1	-214	90.140	-62.033	.080	40.422	22.903	34.051
1626.0	231956.1	22034.5	-216	90.163	-62.077	.044	40.405	22.869	34.219
1628.0	231789.4	22012.9	-218	90.185	-61.968	-.034	40.333	22.835	34.389
1630.0	231621.3	21991.2	-220	90.208	-61.613	.013	40.208	22.802	34.562
1632.0	231451.9	21969.5	-221	90.230	-61.308	.006	40.120	22.768	34.736
1634.0	231281.5	21946.2	-223	90.249	-60.962	.014	40.135	22.732	34.908
1636.0	231110.3	21924.2	-224	90.270	-60.601	.002	40.182	22.698	35.085
1638.0	230938.4	21902.0	-225	90.292	-60.173	-.002	40.103	22.663	35.263
1640.0	230765.9	21880.1	-226	90.313	-59.649	-.013	39.998	22.629	35.443
1642.0	230593.0	21858.2	-226	90.335	-59.058	-.012	39.994	22.595	35.625
1644.0	230420.1	21836.1	-226	90.357	-58.426	.077	40.046	22.560	35.806
1646.0	230247.4	21813.9	-226	90.379	-57.866	.089	40.058	22.526	35.988
1648.0	230075.2	21791.8	-225	90.401	-57.504	.091	40.031	22.491	36.169
1650.0	229903.6	21769.7	-225	90.424	-57.349	.108	40.026	22.457	36.350
1652.0	229732.5	21747.5	-224	90.446	-57.401	.119	40.009	22.423	36.531
1654.0	229562.1	21724.6	-223	90.467	-57.518	.108	40.005	22.388	36.709
1656.0	229392.5	21701.9	-222	90.486	-57.641	.104	40.012	22.353	36.886
1658.0	229223.7	21678.8	-222	90.506	-57.783	.102	40.025	22.318	37.061
1660.0	229055.5	21655.5	-221	90.524	-57.977	.087	39.969	22.282	37.235
1662.0	228887.8	21632.5	-221	90.543	-58.278	.014	39.850	22.248	37.410
1664.0	228719.7	21609.6	-222	90.562	-58.454	.016	39.811	22.213	37.586
1666.0	228551.2	21586.5	-223	90.580	-58.540	.061	39.855	22.178	37.763
1668.0	228382.2	21563.2	-224	90.597	-58.678	.055	39.916	22.143	37.940
1670.0	228212.5	21539.9	-225	90.614	-58.839	.052	39.904	22.107	38.119
1672.0	228041.8	21516.4	-226	90.631	-58.965	.050	39.880	22.072	38.299
1674.0	227870.2	21491.5	-228	90.648	-59.103	.043	39.875	22.035	38.475
1676.0	227697.3	21467.9	-230	90.664	-59.193	-.015	39.883	21.999	38.659
1678.0	227522.7	21444.5	-233	90.680	-58.999	-.022	39.892	21.954	38.846

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 * STILBET USING FLAIR19, INERTIAL-8119D19, NP0264 DYN. DATA. *

 * PAGE 30 *

TIME (SEC)	ALTIME (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
1740.0	221186.3	20675.2	-.322	90.995	-51.871	.073	40.391	20.773	46.319
1742.0	220953.6	20648.7	-.319	91.001	-51.390	.035	40.265	20.732	46.616
1744.0	220723.4	20622.1	-.315	91.006	-51.267	.124	40.213	20.691	46.908
1746.0	220496.1	20595.1	-.312	91.010	-51.484	.091	40.225	20.649	47.194
1748.0	220271.4	20567.9	-.309	91.013	-51.629	.094	40.181	20.608	47.476
1750.0	220044.2	20540.8	-.306	91.015	-51.770	.100	40.078	20.567	47.754
1752.0	219829.0	20513.8	-.304	91.018	-51.901	.118	40.044	20.526	48.031
1754.0	219610.5	20486.6	-.302	91.019	-52.229	.164	40.116	20.486	48.304
1756.0	219393.8	20458.6	-.300	91.019	-52.667	.185	40.163	20.445	48.572
1758.0	219178.7	20430.7	-.298	91.017	-53.168	.139	40.164	20.403	48.836
1760.0	218964.7	20402.8	-.298	91.015	-53.480	.090	40.081	20.362	49.099
1762.0	218751.0	20375.2	-.298	91.012	-53.720	.088	39.974	20.322	49.365
1764.0	218537.1	20347.3	-.299	91.009	-53.893	.109	39.978	20.281	49.630
1766.0	218323.0	20319.4	-.300	91.004	-54.062	.134	40.043	20.240	49.896
1768.0	218108.5	20293.1	-.301	90.993	-54.238	.145	40.052	20.201	50.171
1770.0	217893.8	20264.2	-.301	90.986	-54.440	.153	40.027	20.159	50.435
1772.0	217678.9	20235.1	-.302	90.978	-54.753	.091	40.011	20.117	50.698
1774.0	217463.4	20205.8	-.304	90.969	-54.975	.023	39.965	20.075	50.963
1776.0	217247.0	20176.3	-.306	90.960	-55.103	-.002	39.900	20.033	51.228
1778.0	217029.4	20147.0	-.308	90.950	-55.195	-.028	39.912	19.991	51.498
1780.0	216810.2	20117.3	-.311	90.940	-55.132	.001	39.942	19.948	51.769
1782.0	216589.3	20087.8	-.314	90.930	-55.004	.015	39.962	19.906	52.045
1784.0	216366.7	20057.6	-.317	90.919	-54.827	.013	39.950	19.863	52.322
1786.0	216143.0	20027.0	-.319	90.906	-54.700	-.034	39.980	19.819	52.600
1788.0	215918.2	19996.2	-.321	90.894	-54.585	-.061	39.995	19.776	52.879
1790.0	215692.2	19965.3	-.323	90.881	-54.430	-.054	39.991	19.732	53.160
1792.0	215465.2	19934.2	-.325	90.867	-54.288	-.066	39.969	19.688	53.443
1794.0	215237.2	19902.8	-.327	90.854	-54.171	-.069	39.969	19.644	53.728
1796.0	215008.1	19871.3	-.329	90.840	-54.160	-.121	39.995	19.599	54.014
1798.0	214777.7	19840.2	-.332	90.824	-54.132	-.163	40.021	19.555	54.306

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 * ST198ET USING FLAIR19, INERTIAL-BT19D19, NPO264 DYN. DATA. *

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TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
1860.0	206049.8	18705.5	-0.330	89.972	-49.566	-0.328	39.492	18.085	61.633
1862.0	207837.3	18663.4	-0.321	89.935	-49.042	-0.158	40.474	18.034	61.823
1864.0	207632.2	18620.1	-0.310	89.895	-48.778	-0.139	39.290	17.982	61.988
1866.0	207432.8	18580.6	-0.304	89.861	-48.595	-0.203	38.676	17.934	62.166
1868.0	207238.5	18540.2	-0.295	89.825	-48.257	-0.134	39.402	17.885	62.325
1870.0	207051.5	18498.3	-0.286	89.787	-50.849	.317	39.827	17.835	62.458
1872.0	206868.0	18456.6	-0.286	89.742	-54.002	-0.226	39.724	17.786	62.583
1874.0	206683.5	18415.4	-0.290	89.695	-55.895	-0.214	39.551	17.738	62.715
1876.0	206495.0	18374.7	-0.299	89.646	-57.776	-0.249	39.592	17.694	62.889
1878.0	206299.7	18333.7	-0.313	89.593	-59.579	-0.291	39.710	17.650	63.077
1880.0	206095.6	18291.8	-0.329	89.536	-60.852	-0.357	39.853	17.604	63.280
1882.0	205881.1	18249.2	-0.347	89.476	-61.377	-0.368	39.958	17.558	63.504
1884.0	205655.9	18206.1	-0.364	89.414	-61.445	-0.326	40.032	17.512	63.749
1886.0	205420.0	18162.5	-0.382	89.351	-61.285	-0.279	40.046	17.464	64.018
1888.0	205173.5	18118.7	-0.400	89.286	-61.044	-0.301	40.054	17.416	64.312
1890.0	204916.7	18073.4	-0.417	89.213	-60.621	-0.329	40.064	17.367	64.621
1892.0	204650.2	18029.0	-0.433	89.147	-59.915	-0.278	40.081	17.318	64.962
1894.0	204374.9	17984.7	-0.448	89.062	-59.480	-0.245	40.088	17.270	65.325
1896.0	204091.0	17940.4	-0.463	89.017	-59.034	-0.257	40.125	17.221	65.712
1898.0	203795.3	17895.2	-0.475	88.949	-58.776	-0.154	40.243	17.171	66.113
1900.0	203500.7	17849.6	-0.488	88.881	-58.800	-0.166	40.279	17.121	66.531
1902.0	203195.2	17803.7	-0.500	88.811	-58.771	-0.158	40.280	17.071	66.966
1904.0	202882.7	17757.7	-0.513	88.741	-58.802	-0.200	40.280	17.020	67.419
1906.0	202563.4	17711.2	-0.525	88.669	-58.780	-0.220	40.293	16.969	67.890
1908.0	202237.6	17664.1	-0.537	88.594	-58.583	-0.304	40.293	16.918	68.375
1910.0	201905.9	17616.9	-0.548	88.519	-57.773	-0.312	40.237	16.866	68.877
1912.0	201569.4	17570.0	-0.556	88.439	-56.680	-0.246	40.141	16.815	69.396
1914.0	201229.0	17522.9	-0.562	88.366	-55.960	-0.187	40.137	16.763	69.926
1916.0	200887.7	17475.4	-0.566	88.294	-55.606	-0.194	40.155	16.711	70.462
1918.0	200544.4	17427.8	-0.570	88.222	-55.146	-0.194	40.155	16.660	71.004

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 * ST198ET USING FLAIR19, INERTIAL-BT19D19, NPO264 DYN. DATA. *
 * PAGE 34 *

TIME (SEC)	ALIDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
1980.0	189747.5	15826.8	-678	85.387	-59.305	.088	40.032	14.995	88.583
1982.0	189378.9	15767.6	-686	85.247	-59.277	.085	40.052	14.935	89.178
1984.0	189007.4	15707.4	-694	85.101	-58.826	-.059	40.017	14.875	89.775
1986.0	188634.0	15645.8	-699	84.944	-57.528	-.070	39.844	14.814	90.364
1988.0	188261.5	15585.0	-697	84.798	-56.068	.047	39.708	14.753	90.960
1990.0	187892.8	15523.7	-691	84.651	-55.375	.021	39.635	14.692	91.540
1992.0	187529.4	15462.5	-684	84.505	-54.725	.060	39.539	14.632	92.101
1994.0	187172.1	15401.2	-675	84.358	-54.423	.075	39.413	14.571	92.643
1996.0	186821.5	15339.7	-666	84.209	-54.665	.052	39.384	14.511	93.157
1998.0	186477.1	15277.9	-658	84.058	-54.979	.088	39.361	14.450	93.646
2000.0	186137.9	15216.0	-652	83.903	-55.634	.074	39.338	14.389	94.116
2002.0	185802.7	15153.9	-649	83.745	-56.338	.091	39.355	14.328	94.567
2004.0	185469.9	15091.6	-649	83.584	-57.187	.091	39.390	14.267	95.006
2006.0	185137.4	15027.4	-654	83.414	-58.233	.077	39.439	14.205	95.421
2008.0	184803.0	14964.6	-663	83.245	-59.379	.081	39.524	14.143	95.858
2010.0	184464.3	14901.2	-677	83.070	-60.617	.124	39.696	14.082	96.303
2012.0	184119.1	14837.1	-695	82.890	-62.097	.128	39.864	14.019	96.764
2014.0	183753.9	14772.5	-722	82.705	-63.267	-.045	40.066	13.957	97.253
2016.0	183396.5	14706.8	-748	82.515	-62.489	.042	40.246	13.893	97.774
2018.0	183018.9	14640.4	-769	82.326	-61.312	.057	40.349	13.828	98.324
2020.0	182633.7	14573.7	-785	82.137	-59.749	.067	40.373	13.764	98.899
2022.0	182244.3	14506.7	-794	81.951	-57.877	.118	40.353	13.699	99.486
2024.0	181854.8	14437.2	-794	81.762	-56.107	.162	40.614	13.632	100.038
2026.0	181469.3	14369.0	-787	81.580	-54.177	.065	40.651	13.566	100.593
2028.0	181091.6	14301.2	-770	81.405	-51.524	.114	40.478	13.501	101.123
2030.0	180726.8	14234.2	-744	81.238	-49.577	.201	40.308	13.436	101.611
2032.0	180378.0	14167.8	-714	81.075	-48.800	.262	40.165	13.372	102.043
2034.0	180046.3	14102.2	-683	80.912	-48.722	.227	39.997	13.310	102.417
2036.0	179730.6	14037.2	-655	80.750	-49.174	.266	39.913	13.247	102.731
2038.0	179430.2	13972.5	-629	80.584	-50.119	.327	39.882	13.185	102.987

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 * ST19BET USING FLAIR19, INERTIAL-BT19D19, NP0264 DYN. DATA. *
 * PAGE 36 *****

TIME (SEC)	ALTIDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
2100.0	174054.0	12012.4	-1.040	86.386	43.051	-.058	41.824	11.330	93.986
2102.0	173627.4	11947.6	-1.024	86.657	45.907	-.238	41.783	11.269	94.552
2104.0	173205.8	11881.7	-1.023	86.947	47.882	.154	41.616	11.207	95.079
2106.0	172787.0	11815.3	-1.020	87.233	47.265	-.940	41.392	11.145	95.588
2108.0	172371.0	11748.6	-1.021	87.524	48.530	-.018	41.257	11.082	96.077
2110.0	171955.2	11676.0	-1.026	87.804	48.696	-.125	41.969	11.014	96.467
2112.0	171540.5	11607.2	-1.030	88.103	49.109	-.059	40.907	10.949	96.909
2114.0	171124.3	11541.3	-1.041	88.400	49.398	-.104	40.725	10.887	97.405
2116.0	170706.0	11474.3	-1.051	88.703	49.675	-.137	40.933	10.825	97.886
2118.0	170285.5	11406.9	-1.063	89.009	49.722	-.081	40.839	10.762	98.368
2120.0	169862.4	11339.9	-1.074	89.314	49.137	-.135	40.724	10.699	98.861
2122.0	169437.4	11273.0	-1.084	89.618	48.757	-.146	40.662	10.637	99.363
2124.0	169010.7	11206.3	-1.094	89.922	48.559	-.183	40.625	10.574	99.871
2126.0	168582.4	11138.1	-1.104	90.233	48.572	-.231	40.609	10.511	100.354
2128.0	168153.1	11070.1	-1.111	90.546	49.126	-.130	40.602	10.447	100.842
2130.0	167722.7	11002.3	-1.121	90.862	48.824	-.000	40.518	10.384	101.334
2132.0	167291.2	10935.0	-1.127	91.173	47.531	-.226	40.327	10.322	101.837
2134.0	166860.8	10867.9	-1.128	91.482	47.190	-.226	40.249	10.259	102.336
2136.0	166432.4	10800.8	-1.129	91.793	47.305	-.176	40.175	10.197	102.822
2138.0	166005.7	10733.9	-1.132	92.106	47.732	-.116	40.073	10.135	103.301
2140.0	165579.4	10664.2	-1.139	92.413	48.031	-.126	39.993	10.070	103.719
2142.0	165152.7	10598.3	-1.148	92.732	48.601	-.108	39.932	10.009	104.207
2144.0	164724.4	10532.7	-1.159	93.058	49.288	-.141	39.900	9.949	104.705
2146.0	164293.9	10467.0	-1.174	93.393	49.970	-.054	39.856	9.888	105.207
2148.0	163859.8	10402.1	-1.190	93.731	49.960	-.054	39.692	9.828	105.735
2150.0	163422.1	10338.1	-1.207	94.071	50.034	-.028	39.561	9.769	106.293
2152.0	162980.5	10274.7	-1.225	94.415	50.218	-.023	39.469	9.710	106.878
2154.0	162534.3	10212.3	-1.245	94.762	50.473	-.024	39.357	9.653	107.499
2156.0	162083.1	10154.9	-1.266	95.107	50.756	-.036	39.309	9.600	108.248
2158.0	161626.2	10092.5	-1.292	95.467	50.593	.352	39.287	9.543	108.912

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 * ST198ET USING FLAIR19, INERTIAL-BT19D19, NPO264 DYN. DATA. *

 * PAGE 38 *

TIME (SEC)	ALTUE (FT)	VELA (FPS)	GAMA (DEG)	HOGA (DEG)	SIGMAA (DEG)	BETA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
2220.0	149841.8	8286.9	-1.474	106.410	46.615	.104	35.469	7.886	119.022
2222.0	149398.5	8234.0	-1.508	106.798	45.214	.045	35.341	7.838	119.695
2224.0	148949.1	8182.4	-1.534	107.168	43.994	.013	35.283	7.792	120.435
2226.0	148495.3	8130.2	-1.557	107.545	43.167	.005	35.148	7.744	121.173
2228.0	148037.9	8078.5	-1.578	107.921	42.620	.022	34.827	7.698	121.945
2230.0	147577.9	8026.6	-1.594	108.300	42.434	-.015	34.835	7.651	122.721
2232.0	147116.4	7974.1	-1.610	108.689	42.977	.183	34.797	7.604	123.483
2234.0	146652.7	7921.9	-1.629	109.083	42.353	.249	34.631	7.556	124.265
2236.0	146187.2	7870.2	-1.642	109.470	41.120	.079	34.449	7.510	125.069
2238.0	145721.8	7821.9	-1.648	109.883	40.514	.101	34.294	7.467	125.978
2240.0	145256.1	7769.2	-1.648	110.264	40.000	.087	34.148	7.419	126.735
2242.0	144797.8	7716.0	-1.646	110.654	39.758	.089	33.943	7.371	127.451
2244.0	144341.2	7662.7	-1.643	111.035	39.368	.133	33.635	7.323	128.141
2246.0	143888.3	7609.5	-1.639	111.412	38.877	.134	33.383	7.275	128.807
2248.0	143439.3	7556.2	-1.636	111.783	38.802	.010	33.192	7.226	129.444
2250.0	142993.6	7503.0	-1.638	112.156	39.622	.038	32.973	7.178	130.059
2252.0	142549.0	7442.3	-1.650	112.533	40.510	-.004	32.806	7.123	130.397
2254.0	142103.8	7389.7	-1.667	112.918	41.577	-.039	32.754	7.075	131.012
2256.0	141656.2	7337.6	-1.691	113.314	42.831	-.082	32.685	7.028	131.651
2258.0	141203.6	7286.1	-1.727	113.722	41.874	.644	32.619	6.981	132.332
2260.0	140748.7	7234.8	-1.722	114.086	32.649	.165	32.633	6.935	133.030
2262.0	140305.3	7183.9	-1.663	114.369	23.139	.193	32.591	6.889	133.670
2264.0	139884.1	7134.0	-1.570	114.560	13.174	.177	32.419	6.844	134.212
2266.0	139491.4	7085.1	-1.459	114.652	3.000	.155	32.246	6.800	134.620
2268.0	139129.0	7041.9	-1.348	114.614	-7.477	.072	32.020	6.760	135.059
2270.0	138794.5	6993.6	-1.252	114.498	-18.104	-.004	32.128	6.716	135.136
2272.0	138483.0	6944.4	-1.183	114.280	-28.581	-.029	32.183	6.671	135.033
2274.0	138185.2	6894.4	-1.161	113.964	-38.934	-.011	32.175	6.625	134.810
2276.0	137837.1	6844.4	-1.209	113.557	-48.539	-.460	32.063	6.578	134.573
2278.0	137572.7	6795.2	-1.308	113.108	-51.068	-.354	31.647	6.533	134.450

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TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
2340.0	121893.8	5374.1	-2.589	99.480	-42.240	-.201	25.626	5.257	167.737
2342.0	121390.3	5333.2	-2.643	98.996	-42.330	-.048	25.282	5.220	168.912
2344.0	120890.9	5291.9	-2.697	98.485	-43.688	-.085	25.398	5.183	170.099
2346.0	120335.3	5249.8	-2.755	97.937	-44.836	-.244	25.374	5.145	171.277
2348.0	119873.1	5207.7	-2.818	97.364	-45.326	-.428	25.169	5.107	172.492
2350.0	119354.2	5162.7	-2.878	96.755	-44.403	-.468	24.945	5.066	173.561
2352.0	118830.3	5122.2	-2.925	96.191	-43.304	-.320	24.804	5.030	174.964
2354.0	118302.8	5082.8	-2.968	95.631	-43.000	-.287	24.587	4.995	176.470
2356.0	117771.9	5044.8	-3.010	95.079	-42.507	-.181	24.421	4.961	178.097
2358.0	117238.2	5007.6	-3.051	94.520	-42.865	-.210	24.258	4.927	179.810
2360.0	116701.4	4971.5	-3.092	93.956	-42.675	-.185	24.107	4.895	181.628
2362.0	116161.8	4945.1	-3.126	93.441	-42.451	-.106	23.965	4.873	184.202
2364.0	115619.5	4909.0	-3.167	92.871	-42.633	-.097	23.850	4.840	186.095
2366.0	115074.3	4871.8	-3.210	92.281	-42.964	-.214	23.676	4.807	187.937
2368.0	114526.3	4833.6	-3.252	91.675	-42.616	-.170	23.540	4.773	189.724
2370.0	113976.5	4793.8	-3.288	91.046	-43.109	-.265	23.441	4.737	191.406
2372.0	113425.6	4752.9	-3.324	90.402	-42.609	-.253	23.218	4.700	193.006
2374.0	112874.2	4703.5	-3.359	89.647	-41.606	-.174	22.887	4.655	193.898
2376.0	112323.2	4663.6	-3.390	89.021	-41.582	-.236	22.667	4.619	195.546
2378.0	111772.0	4624.7	-3.421	88.412	-41.130	-.153	22.515	4.584	197.285
2380.0	111221.2	4586.2	-3.443	87.815	-40.912	-.059	22.603	4.549	199.050
2382.0	110672.3	4548.3	-3.462	87.232	-40.744	.085	22.453	4.515	200.843
2384.0	110124.7	4511.4	-3.486	86.659	-41.446	-.042	22.223	4.481	202.707
2386.0	109577.7	4482.2	-3.509	86.218	-41.760	.025	22.138	4.456	205.267
2388.0	109030.9	4444.7	-3.538	85.628	-41.820	.087	21.957	4.422	207.081
2390.0	108483.9	4406.2	-3.576	85.004	-42.790	-.161	21.805	4.387	208.795
2392.0	107936.3	4366.8	-3.612	84.366	-42.029	.006	21.601	4.351	210.421
2394.0	107388.8	4326.5	-3.642	83.721	-41.499	.077	21.494	4.314	211.942
2396.0	106842.8	4285.2	-3.671	83.054	-43.246	-.564	21.225	4.276	213.334
2398.0	106297.8	4232.3	-3.698	82.306	-38.355	.333	21.026	4.226	213.528

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TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
2400.0	105758.1	4192.4	-3.698	81.653	-39.160	.119	20.844	4.190	214.938
2402.0	105224.3	4152.1	-3.671	80.954	-39.741	-.074	21.418	4.152	216.223
2404.0	104701.7	4108.7	-3.641	80.034	-39.427	-.190	20.571	4.112	217.034
2406.0	104137.3	4072.5	-3.630	79.384	-38.660	-.085	20.060	4.079	218.506
2408.0	103678.4	4037.7	-3.626	78.749	-38.355	.041	19.804	4.047	220.048
2410.0	103174.3	4004.2	-3.627	78.102	-38.568	.033	19.571	4.016	221.674
2412.0	102673.5	3970.3	-3.643	77.446	-38.864	.009	19.382	3.985	223.202
2414.0	102174.5	3936.2	-3.668	76.777	-39.537	-.031	19.211	3.953	224.681
2416.0	101676.0	3901.8	-3.701	76.093	-39.727	.018	19.116	3.922	226.101
2418.0	101177.5	3867.3	-3.736	75.399	-39.667	.118	19.017	3.890	227.487
2420.0	100678.8	3831.7	-3.777	74.693	-40.286	.054	18.835	3.857	228.732
2422.0	100179.4	3794.8	-3.817	73.967	-40.242	-.008	18.722	3.822	229.798
2424.0	99679.9	3758.4	-3.858	73.246	-39.934	.079	18.605	3.788	230.897
2426.0	99180.1	3722.0	-3.898	72.516	-40.142	.089	18.466	3.754	231.971
2428.0	98680.1	3685.4	-3.941	71.762	-40.745	.009	18.328	3.720	232.988
2430.0	98179.3	3648.3	-3.993	70.996	-39.995	-.527	18.105	3.685	233.919
2432.0	97679.5	3612.6	-3.987	70.338	-30.418	-.011	18.012	3.652	234.982
2434.0	97192.4	3577.0	-3.878	69.853	-20.954	-.022	17.811	3.618	235.875
2436.0	96727.9	3542.0	-3.705	69.564	-10.796	.065	17.641	3.585	236.562
2438.0	96292.3	3507.1	-3.487	69.484	-.647	.142	17.576	3.552	236.890
2440.0	95888.3	3471.8	-3.266	69.607	8.846	.027	17.478	3.519	236.761
2442.0	95512.7	3436.5	-3.087	69.938	18.711	.045	17.335	3.485	236.252
2444.0	95158.0	3401.1	-2.986	70.477	29.008	.163	17.174	3.451	235.455
2446.0	94811.8	3366.9	-3.004	71.174	36.881	.287	16.862	3.418	234.672
2448.0	94460.8	3333.9	-3.112	71.936	39.976	.065	16.730	3.386	234.078
2450.0	94098.4	3301.3	-3.252	72.754	42.528	.122	16.780	3.355	233.639
2452.0	93722.1	3267.8	-3.409	73.613	43.476	.228	16.796	3.322	233.175
2454.0	93331.7	3233.6	-3.560	74.465	42.614	.105	16.818	3.289	232.737
2456.0	92929.2	3199.5	-3.696	75.316	41.779	-.018	16.768	3.257	232.400
2458.0	92515.9	3165.3	-3.829	76.183	42.428	.148	16.633	3.224	232.128

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 * ST19BET USING FLAIR19, INERTIAL-8T19D19, NPO264 DYN. DATA. *
 * ***** PAGE 46 *****
 * *****

TIME (SEC)	ALTIDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
2700.0	32946.5	735.3	-19.162	3.829	-34.559	-.251	8.681	.734	220.693
2702.0	32475.2	732.0	-13.716	.121	-35.506	-.263	7.908	.729	222.378
2704.0	32009.5	729.4	-13.771	-3.286	-36.307	-.270	7.715	.725	224.442
2706.0	31543.1	726.5	-13.970	-6.734	-37.069	-.179	7.586	.720	226.345
2708.0	31073.3	723.0	-19.161	-10.430	-39.985	-.101	7.865	.715	227.848
2710.0	30600.1	719.7	-19.487	-14.395	-41.589	-.053	7.853	.710	229.506
2712.0	30121.5	716.4	-19.724	-18.661	-43.130	-.049	8.135	.706	231.179
2714.0	29640.6	712.6	-19.874	-23.174	-43.871	.022	8.610	.700	232.534
2716.0	29161.7	707.5	-19.800	-28.080	-44.330	-.110	8.662	.694	232.942
2718.0	28689.5	701.6	-19.636	-33.025	-41.179	-.230	8.391	.686	232.803
2720.0	28225.7	696.0	-19.361	-37.342	-36.411	-.259	8.276	.679	232.687
2722.0	27774.3	688.9	-13.919	-41.061	-33.888	-.292	8.090	.671	231.486
2724.0	27336.2	681.9	-13.627	-44.716	-34.427	-.233	7.985	.663	230.102
2726.0	26907.2	674.6	-13.535	-48.443	-35.664	-.278	7.774	.655	228.476
2728.0	26432.1	667.3	-13.585	-52.151	-33.432	-.372	7.934	.646	226.722
2730.0	26063.9	659.2	-18.338	-55.643	-30.930	-.336	8.096	.637	224.357
2732.0	25653.8	652.9	-13.340	-58.947	-31.576	-.164	8.031	.630	223.089
2734.0	25247.7	647.0	-18.191	-62.593	-32.714	-.250	8.254	.623	222.025
2736.0	24845.4	641.6	-18.377	-66.104	-33.091	-.092	8.172	.617	221.242
2738.0	24441.9	637.3	-18.543	-69.822	-34.109	-.022	8.540	.612	221.166
2740.0	24039.7	633.0	-18.468	-73.904	-34.966	-.200	8.888	.607	221.074
2742.0	23642.3	630.0	-13.278	-78.170	-34.623	-.296	9.058	.603	221.868
2744.0	23252.4	627.5	-17.820	-82.544	-33.243	-.186	9.541	.599	222.899
2746.0	22877.3	624.4	-17.098	-86.823	-32.437	-.010	9.368	.595	223.400
2748.0	22514.1	622.1	-16.889	-90.834	-32.934	-.030	8.930	.592	224.343
2750.0	22156.4	619.8	-16.470	-94.929	-31.912	-.155	9.339	.589	225.319
2752.0	21811.8	617.8	-15.926	-98.946	-31.767	-.078	8.838	.586	226.381
2754.0	21474.8	617.0	-15.692	-102.994	-32.743	-.247	8.700	.585	228.238
2756.0	21145.2	616.0	-15.232	-107.190	-31.685	-.566	8.398	.583	229.942
2758.0	20824.5	615.3	-14.865	-111.123	-31.179	-.907	8.047	.582	231.801

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 * ST198ET USING FLAIR19, INERTIAL-8T19D19, NP0264 DYN. DATA. PAGE 51 *

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHA (DEG)	MACHA (-)	QA (PSF)
3000.0	-180.4	3.4	.796	-62.477	179.814	32.550	177.177	.003	.014

Appendix D

STS-19 Archival Products

D.1 STS-19 Output Products

(a) FILES

<u>NAME</u>	<u>DESCRIPTION</u>
BT19D19/UN=169750N	Final reconstructed trajectory (40 word format per AMA 81-1)
ST19BET/UN=274885C	Final extended BET (66 word format per AMA 81-11)
NAV851A/UN=389102C	STS-19 onboard nav BET (66 word format)
FLAIR19/UN=274885C	Final LAIRS file for STS-19 (ST19MET/un=712662N with NOAA data below 2.1 kft)
TRWST19/UN=274885C	Reformatted JSC/TRW BET (66 word format)
IMRGA19/UN=274885C	Signal difference file (IMU 2 - RGA1/AA1)

(b) TAPES

<u>REEL</u>	<u>DESCRIPTION</u>
NK0165	STS-19 AEROBET (201 words per AMA 82-9)
NK0201	Duplicate of above
NK0202	25 Hz IMU 2 GTFILE (62 words per AMA 81-20)
NK0203	25 Hz RGA1/AA1 GTFILE (62 words)
NK0222	25 Hz unrectified RGA1/AA1 file
NK0233	25 Hz bias rectified RGA1/AA1 file (input tape for NK0203)
NT0663	Final STS-19 residuals from BT19D19
NR0849	Editted tracking tape
NP0302	1 Hz DI-2 for AEROBET generation
NP0264	20 Hz IMU 2 file in body axes (calibrated from BT19D19 solution, used for ST19BET, AEROBET and GTFILE)
NT0662	Dynamic data for reconstruction (20 Hz IMU 2 data in platform)

D.2 Source Tapes Received via NASA LaRC

(a) T/M TAPES

<u>REEL</u>	<u>DESCRIPTION</u>
NH1178/NR0818	OI-1
NK0785	OI-2
NW0214	OI-3 (source for RGA1/AA)
NW0432	OI-4
NE0227	OI-1 from CBET1F

(b) TRACKING TAPES

ND1229	JSC/TRW tracking data
NE0626	Goddard Space Flight Center data

(c) OTHER

NW0453	JSC/TRW descent BET
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				6. Performing Organization Code	
7. Author(s) G. M. Kelly, J. G. McConnell, M. L. Heck, P. A. Troutman, L. A. Waters, and J.T. Findlay				8. Performing Organization Report No. AMA 85-5	
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12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546				14. Sponsoring Agency Code 506-51-13-06	
15. Supplementary Notes Langley Technical Monitor: Harold R. Compton					
16. Abstract The post-flight products for the second Discovery flight, STS-19 (51-A), have been completed and are summarized herein. The inertial Best Estimate Trajectory, BT19D19/UN=169750N, was developed as discussed in Section I using spacecraft dynamic measurements from IMU2 in conjunction with the best tracking coverage available to date for any of the earlier Shuttle entries. As a consequence of the latter, an anchor epoch was selected which conforms to an initial altitude of greater than a million feet. The Extended BET, ST19BET/UN=274885C, incorporated the previously mentioned inertial reconstructed state information and the LaRC generated LAIRS atmosphere, ST19MET/UN=712662N, with some minor exceptions as discussed in Section II. Primary and back-up AEROBET reels are NK0165 and NK0201, respectively. This product was only developed over the lowermost 360 kft altitude range due to atmosphere problems but this relates to altitudes well above meaningful signal in the IMUs. Section III presents summary results generated from the AEROBET for this flight with meaningful configuration and statistical comparisons from the previous thirteen flights. MMLE files were generated based on IMU2 and RGA/AA, respectively. Appendices attached define spacecraft and physical constants utilized (Appendix A), show plots of the final tracking data residuals from the post-flight fit (Appendix B), list relevant parameters from the BET at a two(2) second spacing (Appendix C), and retain for archival purposes all relevant input and output tapes and files generated (Appendix D).					
17. Key Words (Suggested by Author(s)) STS-19, 51-A, Discovery, Best Estimate Trajectory, Atmospheric Evaluations, Aerodynamic Comparisons, Maneuver Extraction Files			18. Distribution Statement Until April 1987 Subject Category 16		
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